April:

3 of 1866

Sl. No. 1–10.

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Previous references.

1866-67
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(Agriculture)

File No. 3.

Serial Nos. 1—10

Later references.

GENERAL AND REVENUE SECRETARIAT.

Serial Nos. 1—10.

A ~~Part~~ B for

SUBJECT.

Cinchona alkaloids.

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1867. No 293

From The Govt Office. Rev. Dept.
To Fort Saint George

Dated 31st Jany.
Despatched
Received 1 Feb 1867

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General } 186 – 6.

Forwards 100 ea, Specimens of the Extract from the Reports on the Govt Chinchona Plantations & Bots. Medical Gardens for 1863-64 and 1864-65

No 43

EXTRACT

FROM THE

REPORT ON THE GOVERNMENT CHINCHONA PLANTATIONS AND BOTANICAL GARDENS ON THE NEILGHERRIES FOR 1864-65.

* * * * *

Paragraph 2. Owing to the large number of plants produced, and consequently the employment of much labor in this operation, we have found it necessary, in order to economize and lessen the cost of propagation, to abandon the system of placing the cuttings on a piece of brick, as described in previous reports. The method now adopted is to fill the pots as formerly with prepared soil, but only to within an inch or three-fourths of an inch of the surface; this space is then filled up with pounded brick dust, into which the cuttings are inserted as at A in Figure I; B, representing the stratum of brick dust; C, the ordinary soil used and described in previous reports; D, moss to facilitate drainage; E, the pot-sherd or draining material. Under this treatment the cuttings are found to root more freely than by the method previously adopted, while a man can pot off in a day from four to five times the number of cuttings. This simple expedient, which may scarcely appear worth detailing, is of great importance in extensive propagating operations, as it reduces the cost to nearly one-fifth of that originally incurred, and at the same time economizing space in the propagating cases, as by the present system double the number of cuttings can be placed in a four inch pot.

Propagation of the plants, alteration in system of.

Cuttings now planted in brick dust.

When thus treated root more freely.

This system much reduces the cost of propagation.

3. The cuttings when rooted in the propagating cases are not as hitherto transplanted into larger pots, but the cutting pots removed into the hardening cases, and when hardened off, the plants are placed singly into pots two inches in diameter, and

Rooted cuttings not transplanted from cutting pots until hardened, when they are put singly into pots formed of cowdung and sand.

about 3½ in depth, formed of a mixture of cowdung and sand as illustrated at Figure II.: A, being the cowdung pot; B, the soil; C, the plant; D, a section. These pots are, prior to use, dried in the sun, by which they become hard and in every respect answer the purpose of an ordinary pot, when buried in the soil they become soft by the moisture, and in this condition are easily penetrated by the roots of the plants, but are still sufficiently adhesive to permit of handling, without breaking, when removing or transplanting the plants.

4. These cowdung pots are made by hand, and a man will make from 400 to 500 per diem; they are thus produced at less than $\frac{1}{100}$th part of the cost of an ordinary pot, while they more effectually answer the purpose required in giving nourishment to the young plants, and in the operation of permanently planting out, admits of the pot with the plant being at once placed into the soil, thus avoiding the injury done to the roots in removing the plant from ordinary earthen pots.

The cowdung pots cheaper and better than the ordinary earthen pots, and admits in permanently planting out of being placed together with the plant into the ground.

5. The first Chinchona plants were permanently planted out on the 30th August 1862. The eleven plants of C. Succirubra planted by His Excellency Sir William Denison and Staff, made an average growth of three feet from that time to 30th April 1863, the circumference of the stems, at six inches from the ground, varying from two to three and half inches; and from the 1st of May 1863 to 30th April 1864, these plants made an average perpendicular growth of two feet eleven inches, with the circumference of the stems varying from six to nine inches; and from the 1st May 1864 to 30th April 1865, these plants attained an average perpendicular growth of one foot six inches, with stems varying from eight to twelve inches in circumference. The perpendicular growth of these individual plants in the official year 1863-64, exceeded the average growth of the same species throughout the plantation by about three inches. This year, however, these plants have not attained the average growth of those on the plantation, in consequence of the heavy storms which have prevailed, and the situation in which they are planted, being exposed to the full force of the western winds. On the first Denison Plantation the C. Succirubra was planted at ten and twelve feet apart, and the branches of many of these plants are now touching each other, presenting the appearance of a luxuriant young forest. The bark has much increased in

Condition and growth of plants.

Growth of the plants planted by the Governor and Staff in August 1862.

Bark much improved in thickness.

thickness, while the markings characteristic of the finest Peruvian bark become more and more apparent; mosses and lichens having developed themselves upon the stems of the oldest plants. This, in combination with the healthy growth of the trees, now establishes, beyond all doubt, that the Chinchona bark can be grown on the Neilgherries to as great perfection as in the most favorable localities on the Andes.

Can be grown to great perfection on the Neilgherries.

The C. Succirubra still continues to grow most robust and to produce the thickest and the largest quantity of bark in a given period; this species is also very hardy, and would no doubt be most profitable to cultivate at elevations varying from 4,000 to 6,000 feet. One plant of this species has already produced perfect seeds, and as upwards of a thousand plants are now in bloom, we may shortly expect to be able to supply abundance of seed of this valuable species, which stands pre-eminent in the quantity of alkaloids it produces, also in the thickness of its bark, and in its luxuriant and rapid growth; in short, it possesses in the highest degree, every quality necessary in a plant intended for profitable cultivation.

C. Succirubra the most profitable species to cultivate.

6. The C. Officinalis (Condamenea) in cultivation promises to rank second in value, producing a bark nearly equal in thickness to C. Succirubra, but the plant is of less luxuriant habit, although more hardy and better suited for cultivation in exposed situations and high elevations. This species, together with its varieties, Crespilla and Bonplandiana, should invariably be selected for cultivation at high altitudes, as they thrive best at elevations varying from 6,000 to 8,000 feet; some plants of the C. Officinalis are coming into bloom, and possibly may produce perfect seeds this season.

C. Officinalis and its varieties next in value.

And better suited for growth at high elevations and exposed situations.

7. The C. Calisaya has hitherto only been planted at elevations varying from 4,000 to 6,000 feet, and here the plants thrive well, although the habit of this species is less vigorous than the "Red" or "Crown" barks, the stems scarcely increasing more than half as much as these species in thickness during the same period of growth, and consequently as a bark producing tree is less valuable. A few plants of the Calisaya, accidently placed out at a high elevation (7,300 feet), seem to have adopted a much more luxuriant habit, than those planted at lower eleva-

C. Calisaya rich in Quinine, but of slow growth.

Seems to grow best at high elevations.

tions, consequently a number of this species will be planted during this season at much higher elevations than hitherto. Several plants of the C. Calisaya planted on the 1st Denison Plantation in November 1862, are now in full bloom, presenting a most beautiful appearance, while their fragrance fills the air for a considerable distance.

Now in full flower on 1st Denison Plantation.

8. The C. Lancifolia, received from Java, much resembles the C. Calisaya in its habit and growth, but our experience with this species has been too short to admit of an opinion being formed of its ultimate value as a cultivated plant. The plant, no doubt, is the true C. Lancifolia of botanists, and is a most valuable species for the production of Quinine.

C. Lancifolia resembles Calisaya.

9. The propagation of the "Grey" barks, C. Micrantha, C. Peruviana, and C. Nitida, has been discontinued, in consequence of the small quantity of Quinine produced by these species; although they yield a considerable quantity of Chinchonine, yet the value of this being much inferior to Quinine, it has been considered undesirable further to extend their cultivation. Many of the older plants of these three species are now coming into bloom.

Propagation of Grey Barks discontinued.

Many of these species now in bloom.

10. The C. Pahudiana could be grown to any extent in this locality, but in consequence of the uncertain value of the plant, it has not been propagated. A few of this species are also now in bloom.

C. Pahudiana.

11. The treatment described in previous reports has been found adapted to the requirements of the plants, but in order to lessen the labor and risks from carelessness in transplanting, some modification in our former treatment has been found necessary. The plants being established in the hardening cases, are planted in the nursery beds as illustrated at Figure III.: A being a transverse section of a row of cowdung pots as placed in the beds, and filled in between with earth; B showing a longitudinal section of the bed, the pots being placed at the distance of $2\frac{1}{2}$ inches apart, and the spaces between them filled up with earth to a level with the stem of the plants. In this way the plants can be removed and transplanted by untrained laborers without danger of damage to their roots. In removing the plants from the nurseries to be permanently planted out, they are raised from the nursery beds and arranged on a light dealwood tray, two feet by three feet as at Figure IV, B;

Cultivation, modification in system of.

this tray being filled, is lifted by the handles and placed in the bottom of a box as at C; another tray is filled in like manner, and three round sticks being run through holes in the sides of the box at D; the second tray E is placed on and supported by these sticks, and the third tray F treated in the same way. The box now being filled and containing about 540 plants, is lifted by the pole G and carried by two men to the planters where it is deposited, the same men returning with an empty box to be re-filled. The planters first draw out the pole and remove the upper tray F from the box, and proceed to plant out the plants as illustrated at Figure V, A, filling in the soil in the manner shewn at B; this completed, the plants are immediately shaded with split pieces of wood as at Figure VI, and the operation of planting is finished. When the plants have grown above the wood, they are protected from chafing by a grass rope being twisted round the top as at H. This rough split wood, as a protection and shade for the young plants, has been found quite as efficient as the baskets described in paragraph 27 of last year's report, and requires less labor, as one man in this manner is able to shade from fifty to sixty plants per day. The distance at which the plants are now placed, when permanently planted out, are for the "Red," "Grey," and "Yellow" barks 7 × 7 feet. The "Crown" barks in very exposed situations 4 × 4 feet, in medium exposed places 6 × 6 feet, and in sheltered localities they are also placed 7 × 7.

More economical and as effectual as baskets.

Distance at which the plants are planted.

12. On our principal plantations the land was entirely cleared of forest prior to planting, but on the 1st Dodabetta plantation, also on some portions of the 2nd, the forests were only partially cleared, in order to test the effect of cultivating the plants under the shade of living trees, and the experience of upwards of two and a half years, although comparatively short, is still, I think, sufficient to establish beyond doubt that they cannot be successfully grown under living shade. The plants in such situations are weak, 'drawn,' and liable to damp off in continuous wet weather, and they suffer much more from gales of wind than in open and even exposed places, while the accidental falling of the forest trees, which occasionally takes place, destroys many of the young plants.

Cultivation under the shade of living trees.

Principal plantation entirely cleared of forest.

Dodabetta plantation partly under living shade, plants do not grow well.

Are also injured by the falling of the forest trees during storms.

13. Altogether about forty acres of Chinchona have been planted under living shade, and I would respectfully suggest that while the Chinchona plants are young, the forest trees be removed from about thirty acres, preserving ten acres by way of experiment, as it will probably be thirty or forty years before any return can be expected from plants grown under the shade of forest.

Suggests that the forest trees be removed.

* * * * *

19. The elevations found best suited to the growth of C. Succirubra or 'Red' bark is about 6,000 feet, the plant, however, will grow at considerably greater elevations as also down to 4,000 feet, but they have been found to thrive best at elevations varying from 5,000 to 6,200 on slopes facing the north, and well sheltered from the N. E. and S. W. monsoons. On the 1st Denison and Markham Plantations, which possess this aspect, nothing could be more satisfactory than the growth of these plants, while on the lower portion of the 2nd Denison Plantation, which is very much exposed to the S. W. monsoon, and to the full effect of the rays of the afternoon sun, during the dry season, the growth of this species has been very unsatisfactory, the plants being stunted in consequence of the soil becoming parched and dried up during the months of February and March, while they are cut to pieces in the months of June and July by the violence of the winds. Various expedients have been adopted to counteract these disadvantages, and although none of them have proved quite effectual, they have been so far useful in protecting the plants as to merit description.

Cultivation, elevations and exposure best suited to.

Elevation and exposure best suited to the "Red Bark."

Effects of exposure on.

20. The plants when young are shaded and protected as described in paragraph 11, and when they attain the height of one foot or eighteen inches, they are staked, and tied with grass ropes as at Figure VII, A and B, great care being taken to see that the grass rope does not touch the stem of the plant, as when this is the case, the movement of the plant with the winds cuts the bark through at the point of contact with the rope, and destroys the plant; this can be effectually avoided by drawing the rope up to encircle the leaves and small branches when present, so that the leaves or branches come between the rope and the stem of the plant. This requires particular attention; because, if not attended to, a whole plantation might be destroyed in one storm, it being much better that the plants be not tied at all, if not secured effectually.

Means of protection.

21. The various species of "Crown" Bark, C. Officinalis (Condamenea), Bonplandiana (Uritusinga), and Crespilla, thrive best at elevations varying from 6,000 to 8,350 feet, the latter being the highest elevation at which the plants are grown here. These species or varieties, when well secured as described in the preceding paragraph, grow in any exposure, and even where exposed to the full force of the monsoons they are not much injured, although their leaves become shattered by the storms, fresh leaves however being immediately produced, the plants are not materially damaged. These species will not grow in land-locked hollows subject to severe frosts, but otherwise can be grown in almost every soil on the plateau of the Neilgherries, apparently succeeding as well in grass land as in forest. Although the "Crown" Barks bear this amount of exposure, nevertheless like all the other species of Chinchona they thrive best in well sheltered situations with a N. or N. E. aspect, as these localities maintain a more uniform moisture throughout the dry season, and this is highly beneficial to the growth of Chinchona.

Elevations and aspects for the "Crown Barks."

Bears considerable exposure.

But prefers sheltered positions.

22. The "Yellow" Bark, or Chinchona Calisaya and its varieties grow well at 5,000 to 6,000 feet, and also in the Wynaud at 3,000 feet; these are the only elevations at which we have grown the plants. This species although valuable for the production of quinine, does not promise to be a profitable plant under cultivation, in consequence of the thinness of its bark and slow growth, a few plants unintentionally placed out at a much higher elevation than formerly (7,300 feet) have assumed a more robust habit than those planted at a lower altitude.

"Yellow Bark."

23. The "Pitayo" Bark, C. Lancifolia, has been planted out at an elevation of 7,600 feet, but owing to the few plants and the shortness of our experience with this species, it is impossible at present to state with any certainty the elevation best suited to the cultivation of the plant.

"Pitayo Bark."

24. The "Grey" Barks, C. Peruviana, Nitida, and Micrantha, have been found to grow well in the localities in which they were originally planted, at elevations varying from 4,500 up to 6,000 feet, flourishing best at the highest elevation and in sheltered positions facing the north.

"Grey Bark."

During the present year these plants have not been propagated in consequence of the small quantity of quinine they produce, they are nevertheless rich in chinchonine.

C. Pahudiana.

25. The C. Pahudiana continues to flourish both at an elevation of 5,000 and 7,400 feet, but this has also not been increased in consequence of the uncertain value of its bark. Another species nearly allied, if not identical with the Pahudiana, has recently been received from Java, but none of these have yet been permanently planted out.

Cultivation, soils best suited for.

Soils best suited to the growth of Chinchona.

26. The C. Succirubra or the "Red" Barks thrive in a dark crown deep vegetable mould, resting upon an open subsoil. The C. Crespilla in peaty land, the C. Officinalis also grows freely in this soil, but prefers a deep brown mould; this species is also found to grow well in the laterite soils so common on the plateau of the Neilgherries. The "Yellow" and "Grey" Barks prefer the same soil as the C. Succirubra, while the C. Lancifolia and Pahudjana indicate the preference for a dry and gravelly soil.

Cultivation, effects of storms and wet weather upon.

Plants when established are not liable to be blown down.

27. The different species of Chinchona are found to establish themselves securely in the ground, in consequence of their throwing out a dense moss of fibrous root, much like the Rhododendron: and thus the plants are secure against being blown down even in the heaviest storms. In exposed situations, however, the stems are occasionally broken off, while the foliage of the larger leaved species are much tattered, and have sometimes been blown away entirely; however, as the plants attain age, the leaves become smaller and are less affected by the wind. The greatest injury the plants receive is from the branches striking against each other, and damaging the bark.

Effected by continuous wet weather.

28. The continuous rain during the last monsoon proved less injurious to our plants than the preceding one, the plants of younger growth having suffered most, only five plants of the "Grey" Barks having died during the monsoon, while twenty-five were lost from the effects of the previous monsoon. The "Grey" Barks suffer most from the effects of heavy and continuous rain, while the leaves of all the species assume a yellow tint, indicating the presence of a superabundance of moisture, but this has only proved fatal to a few plants of the "Grey" Barks. All the

species luxuriate and make most vigorous growth in the seasons alternated with showers and sunshine, and even continue to grow well for two months after the rain has ceased, thus establishing that they bear a considerable amount of drought without injury.

* * * * *

Considerations prior to reaping our first harvest of bark.

31. The period being rapidly advancing when we must begin to harvest our bark, it becomes a matter of serious consideration to devise the best means of preparing it, and if possible extracting the alkaloid on the spot, in order to save the cost of carriage. Connected with this subject I would much like the benefit of a personal consultation with Mr. Markham, especially as this gentleman has obtained much valuable information by experience in South America, and his intercourse with scientific men in Europe on the best methods of extracting the alkaloids. Moreover, an inspection of our plantations would enable Mr. Markham to draw a correct conclusion as to the state and health of the plants here, compared with those on the Andes.

Yield of Alkaloids yearly increasing.

Must shortly attain the maximum when it should be gathered.

32. In South America the bark is gathered at random, and without reference to the period of its growth, of the best seasons for obtaining the alkaloids. The results of our observations are so limited that it is impossible to draw from them reliable practical deductions. I would, however, notice that our barks have increased in the produce of their alkaloid at the rate of about 2 per cent. per annum. As it cannot be supposed that the barks can continue to increase in this ratio, a period must occur at which the maximum quantity of alkaloids are contained in the bark, and after this there will, in all probability, be a period of deteriorations, should this be the case it is of vital importance for us to ascertain, and reap our harvest of bark at that period of growth when the bark contains the greatest amount of alkaloid. This refers principally to the removal of the bark from the stems of the trees, as the operation of lopping and barking the branches may have to be proceeded with for the sake of convenience, and to give light and air to the plants prior to the bark having attained its maximum quantity of alkaloid.

33. Mr. Howard's analysis of the bark, submitted in May last, will give much information on this subject, for if our last sample of bark gives an increase over that submitted in May 1864, it will be undesirable for us

to harvest our bark until this yearly increase has ceased or at least become unimportant.

Plants when cut down for their bark rapidly produce new shoots.

34. All the species have been found to throw out shoots from the stools when prepared, as described and illustrated at paragraph 21, Plate VI., in the Manual on Chinchona cultivation, dated March 1863. This will necessarily have to be practised when the plants are placed close together, and it becomes necessary to remove each alternate tree to give light and air to the plantation.

Recommends from 7,000 to 10,000 plants to be covered with moss.

35. The quotations at foot will, I trust, be sufficient to establish that no injury can accrue from the application of moss to the stems of our plants, and with the permission of Government I will at once moss from 7,000 to 10,000 of our largest plants, preparatory to removing the bark.

"*Report of an analysis of the third remittance of Bark from India.*"

"From J. E. HOWARD, Esq., to the Under Secretary of State for India, June 15th, 1864.

"SIR,—I have the honor to report that I received on the 20th May, the specimens "mentioned by Mr. McIvor in his despatch of 17th March last, and that the same were all "in good condition. I have since devoted most careful attention to ascertain by experi- "ment the probable market value especially of the first two samples of the bark sent. It "will not be necessary for me to detail the various means by which I succeeded in convinc- "ing myself, not only of the existence of the alkaloids, but of their being extant in such a "state of purity as is certainly not found in the ordinary samples of Red Bark imported "from South America. The result of my examination tended to show distinctly that "cultivation has improved the produce of at least this species of Chinchona.

"I must remark that the commercial value of specimens of bark intended for the "manufacture of Sulphate of Quinine can never be ascertained by the mere knowledge of "the per-centage of alkaloid soluble in Ether, since it is necessary that this should be "shewn to exist in such a state as to crystallize with acids into the required compounds.

"In the case of No. 1, the bark from the thickest part of the lower branches of "C. Succirubra, two years and five months old, this examination was most satisfactory, "confirming that which I stated in my first Report as to the facility with which the alkaloids "were obtained in a state of purity, although the amount of red coloring matter in the "bark is very great. The amount of purified alkaloids I estimate at 6 per cent.; consisting "of Quinine 3·14, Chinchonadine 2·06, Chinchonine 0·80. This large product of alkaloids "might probably be still further increased by surrounding the stem with moss, in the "manner which Mr. McIvor has so happily suggested, since Dr. deVry found 8·409 per cent. "of alkaloids in a stem which had been so treated. It seems to me, from the trial, that "the East India Bark, the produce of C. Succirubra, will rival in price the Bolavian "Calisaya, which is by no means the case with the bark of the branches of the C. Succiru- "bra as grown in South America. It is important to remark, that the very high "price of between 8s. and 9s. which has quite recently been paid for Red Bark in this "market, applies only to those pieces of bark from the trunk of the tree which possess from "their age a peculiarly bright red appearance; I have forwarded a small vial with com- "mercial Sulphate of Quinine obtained from this No. 1, as also Sulphate of Chinchonadine "separated from the above. I have only to remark further on this bark that its appearance "bespeaks its good quality, and that there can be no doubt the season chosen (24th of "February) is most favorable to its being well secured."

Specimens examined.	Alkaloids in 100 parts.	Quinine.	Chinchonine and Chinchonadine.	Chinchonine and Quinidine.	Quinovic acid.	Analytical data.
3. C. Succirubra						
a. Bark of the stem ...	2·657	1·486	1·171	.....	0·398	41·7 grm. of bark of the stem produced 1·108 grm. of Alkaloids, and 0·166 grm. Quinovic acid; of the Alkaloids, 0·62 grm. were dissolved by Ether.
b. Bark of the root ...	7·514	3·443	4·071	.....	0·533	21·2 grm. bark of the root produced 1·593 grm. Alkaloids, and 0·113 grm. Quinovic acid; of the Alkaloids, 0·78 grm. were dissolved by Ether.
c. Stem-wood ...	.....	.....	.....	.....	0·212	25·0 grm. dry stem-wood produced 0·053 grm. Quinovic acid.
d. Root-wood ...	.....	.....	.....	.....	0·867	18·8 grm. dry root-wood produced 0·163 grm. Quinovic acid.
4. C. Succirubra Leaves	0·017	.....	.....	.....	1·300	32·4 grm. dry leaves produced 0·436 grm. Quinovic acid, 76·7 grm. dry leaves produced only 0·013 grm. of very impure Alkaloids containing not a trace of Quinine.
5. C. Succirubra Bracts	.....	.....	.....	.....	0·870	15·3 grm. dry bracts produced 0·133 grm. Quinovic acid.
6. C. Succirubra Juice dried in the sun.	.....	.....	.....	.....	*x*	2·045 grm. dried juice was proved to contain not a trace of Alkaloids, but Quinovic acid was readily detected.
7. C. Succirubra Bark of the stem ...	3·409	2·765	5·644	.....	0·530	14·9 grm. dry bark produced 1·253 very slightly colored Alkaloids, and 0·08 grm. Quinovic acid; of the Alkaloids, 0·412 grm. were dissolved by Ether.
8. C. Calisaya						
a. Bark of the stem ...	1·890	1·220	.....	0·670	0·640	14·5 grm. dry bark produced 0·274 grm. Alkaloids, and 0·093 grm. Quinovic acid; of the Alkaloids, 0·177 grm. were dissolved by Ether.
b. Bark of the root ...	3·100	*x*	.....	*y*	*x*	3·25 grm. dry bark of the root produced 0·103 grm. Alkaloids, partially soluble in Ether.
9. C. Calisaya Bark of the stem ...	1·520	0·724	.....	0·796	0·230	8·7 grm. dry bark produced 0·133 grm. Alkaloids, and 0·02 grm. Quinovic acid; of the Alkaloids, 0·063 grm. were dissolved by Ether.
10. C. Pahudiana						
a. Bark of the stem ...	0·450	*x*	*y*	.....	*x*	11·1 grm. bark produced 0·05 grm. Alkaloids, for the greatest part soluble in Ether.
b. Bark of the root ...	1·553	*x*	*y*	.....	0·450	11·2 grm. bark produced 0·174 grm. Alkaloids, and 0·051 grm. Quinovic acid. The Alkaloids were partially soluble in Ether.
11. C. Pahudiana Leaves	0·010	.....	.....	.....	0·150	32 grm. leaves produced 0·048 grm. Quinovic acid, and 0·004 grm. very impure Alkaloids.
12. C. Micrantha						
a. Bark of the stem ...	2·791	.....	.....	.....	0·113	28·3 grm. bark produced 0·79 grm. Alkaloids, and 0·032 grm. Quinovic acid; of the Alkaloids, 0·346 grm. were dissolved by Ether.
b. Bark of the root ...	4·166	*x*	.....	.....	0·678	18 grm. bark produced 0·75 grm. Alkaloids, and 0·122 grm. Quinovic acid; of the Alkaloids, 0·15 grm. were dissolved by Ether.
13. C. Micrantha Leaves	traces.	.....	.....	.....	1·276	28·4 grm. leaves produced 0·36 grm. Quinovic acid, 209 grm. leaves produced only 0·008 grm. very impure Alkaloid.

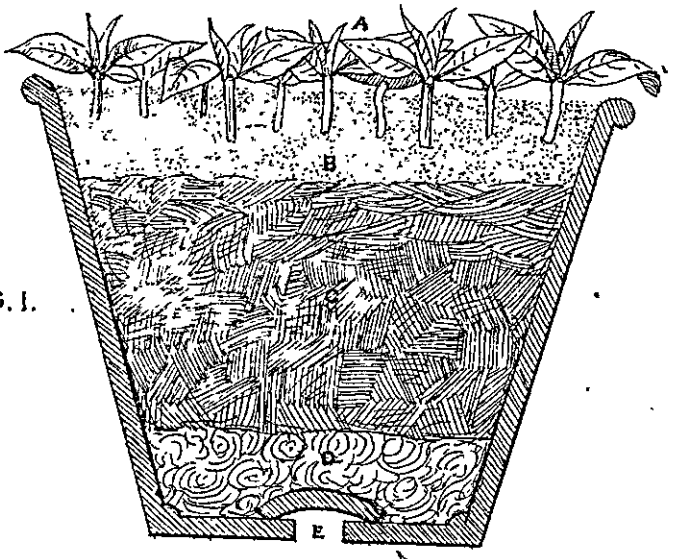


FIG. I.

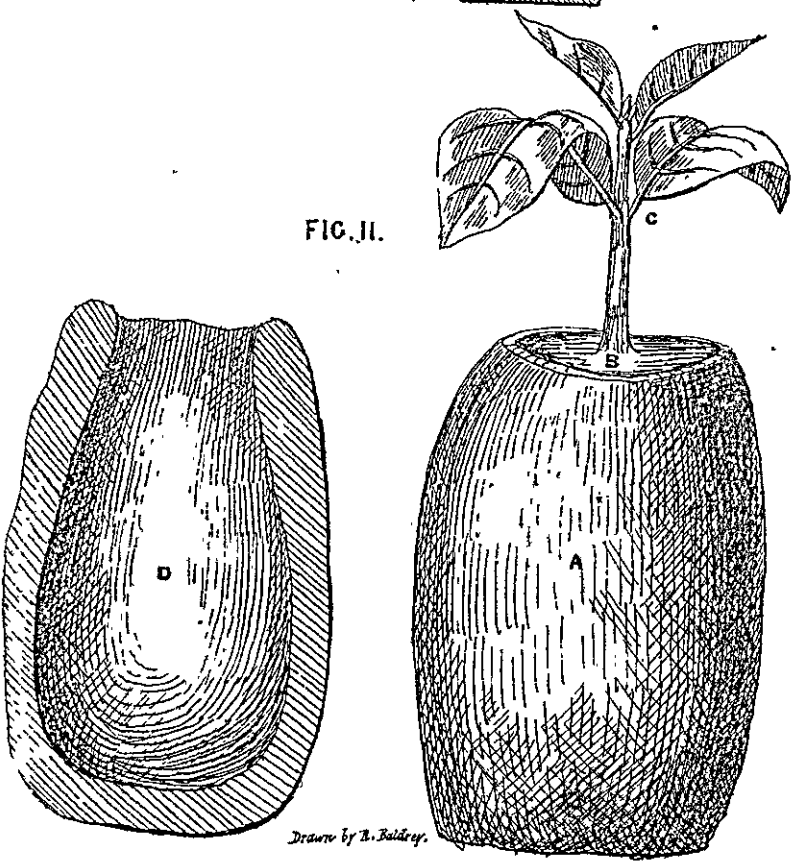
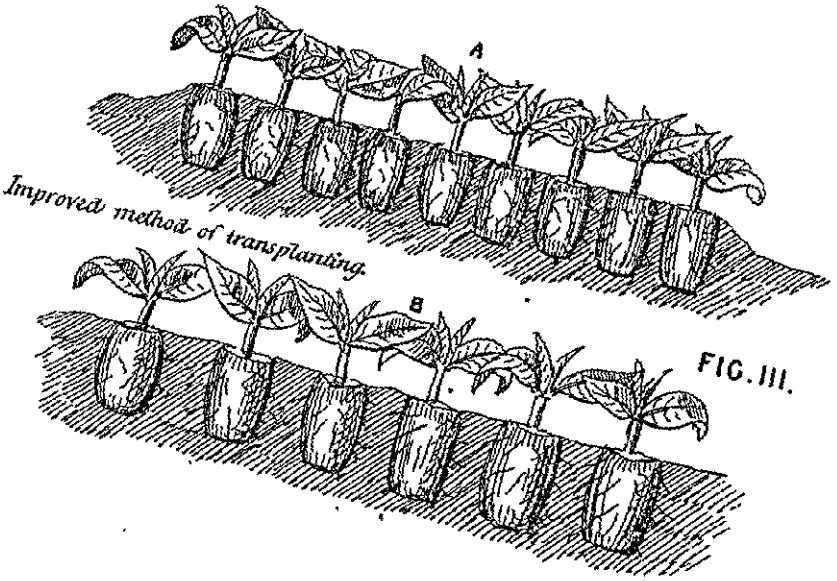
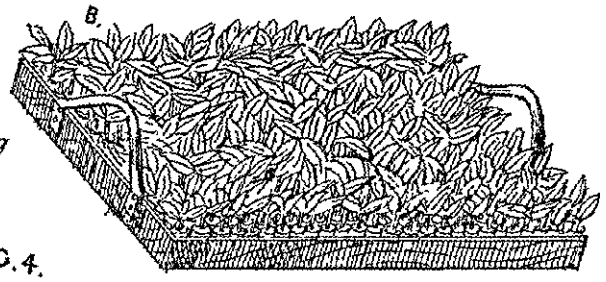


FIG. II.



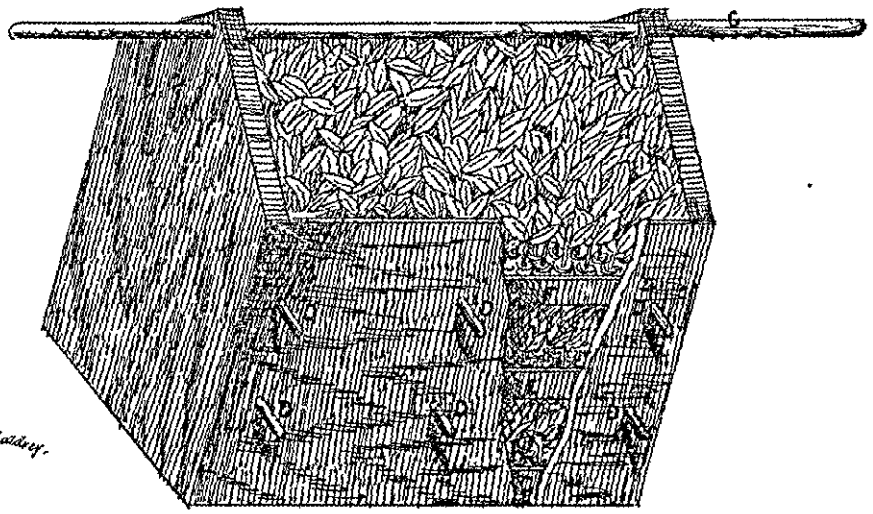
Improved method of transplanting.

FIG. III.



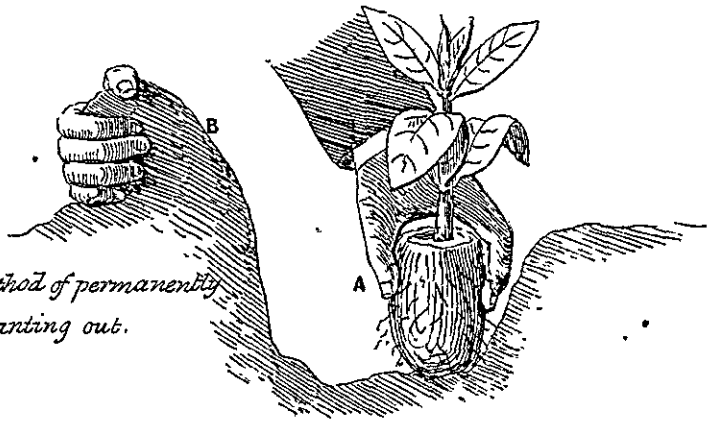
Method of transporting the plants.

FIG. 4.



Drawn by T. Baldrey.

FIG. V.

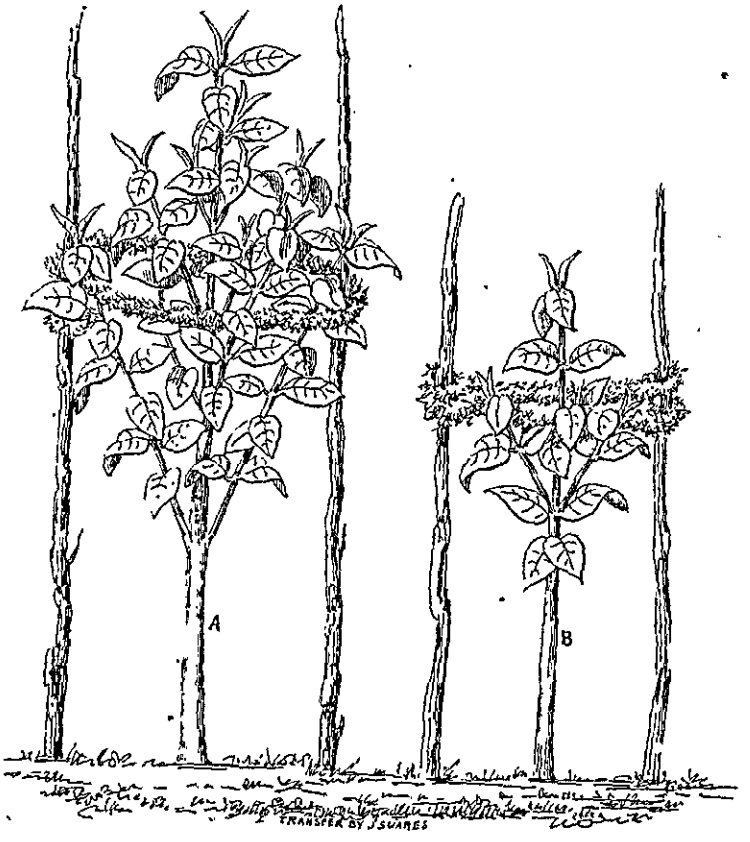


Method of permanently planting out.

FIG. VI.

Rough wood protection and shelter for young plants

FIG. VII.



EXTRACT

FROM THE

REPORT ON THE GOVERNMENT CHINCHONA PLANTATIONS AND BOTANICAL GARDENS FOR 1863-64.

* * * * *

Paragraph 9. Forming an opinion on our experience up to the present time, the elevations best suited to the growth of the different species of Chinchona appears to be in this latitude for the Succirubra from 3,000 to 6,000 feet, probably thriving best at altitudes from 4,500 to 6,000. This is perhaps the hardiest species in cultivation bearing, without material injury, greater extremes of heat and cold than any of the other species yet introduced.

C. Succirubra grows at elevations from 3,000 to 6,000 feet.

The most hardy of all the species.

10. C. Calisaya thrives best at an elevation of about 5,000 feet, it appears not to bear a high temperature, although in the Wynaad District it grows at 3,000 feet.

5,000 feet the best elevation for C. Calisaya or yellow bark.

11. The C. Peruviana, Nitida, and Micrantha grow well at elevations of 4,500 feet, and in sheltered localities at 6,000 feet.

Grey barks thrive best at elevations of about 4,500 to 6,000 feet.

12. C. Officinalis and its varieties flourish best at elevations from 7,000 to 8,500 feet; it makes rapid perpendicular growth at lower elevations, but is not so robust and luxuriant.

Crown barks at elevations from 7,000 to 8,500 feet.

Makes more perpendicular growth at lower elevations, but is not so robust.

13. Of the C. Lancifolia only two plants have been tried at an elevation of 7,600 feet, these stood the cold of last winter without injury, and the species may probably be found to require the same elevations as C. Officinalis and its varieties.

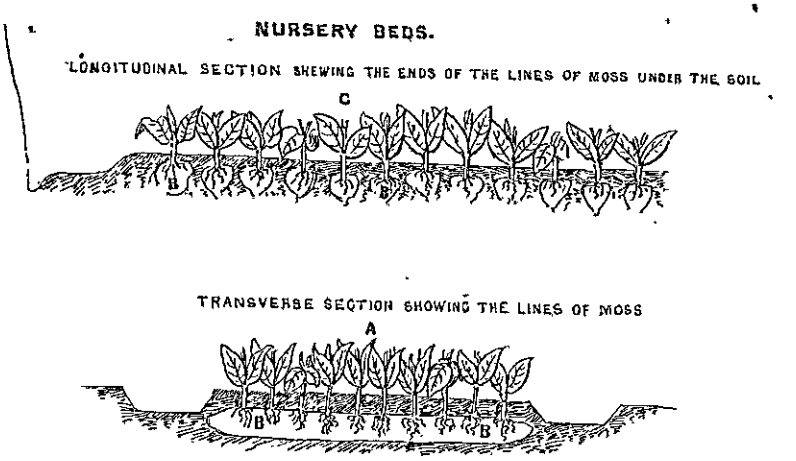
Two plants of C. Lancifolia Pitayo bark planted out at an elevation of 7,600 feet appears to require the same elevation as the crown barks.

* * *

24. The treatment described in previous reports and "Notes on cultivation, 6th March 1863," has been found generally adapted to the requirements of the plants, especially as regards their propagation. In transplanting from the propagating houses into the nurseries a modification has been found necessary. In order to enable the plants to be removed without damage

Cultivation. Modification of former treatment.

Transplanting plants in nurseries.



to their roots, a layer of moss is introduced under each line of plants. A. represents a transverse section of the nursery bed with moss B. introduced, C. being the longitudinal section. The manner in which the plants are planted being the same as described in paragraph 26, it being essential to success not to catch the roots of the plants in the hand, as the least bruise destroys them, therefore the plants should invariably be lifted by the leaves.

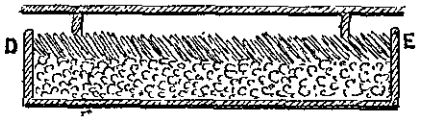
Roots must not be handled.

25. In permanently planting out, the distance apart has been reduced from 10 and 12 feet to 6 and 7, and a modification of our former method of planting has also been found necessary. In order to facilitate this operation the plants when removed from the nurseries, beds, or pots are laid in

Permanently in the plantations.

Removing plants from nurseries to plantation.

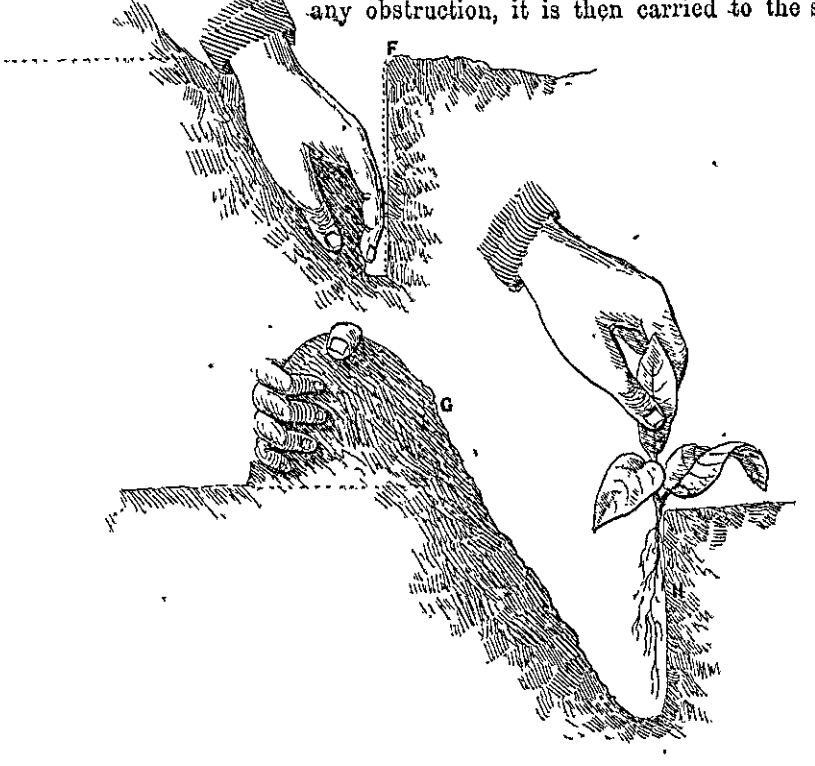
SECTION OF BOX FOR CONVEYANCE OF PLANTS FROM NURSERIES TO PLANTATIONS, THE COVERING BEING RAISED ABOUT 2 INCHES ON CROSS BARS TO ALLOW A FREE CIRCULATION OF AIR OVER THE TOPS OF THE PLANTS, WHILE IT SHELTERS THEM FROM THE SUN.



a deal box in nearly a horizontal position between thin layers of moss, beginning to fill the box at D. and finishing at E., in this way from 1,000 to 2,000 plants are placed in each box, and carried by one or two men from the nursery ground to the planters, where the box is placed in the centre of the line between the planters in order that it may be conveniently moved along as the operation proceeds. The planters remove the plants one at a time beginning at E. and continue this operation until the box is emptied.

26. Each plant is lifted from the box by catching the leaves between the forefinger and thumb of the left-hand, while with the right-hand the roots are freed from any obstruction, it is then carried to the spot

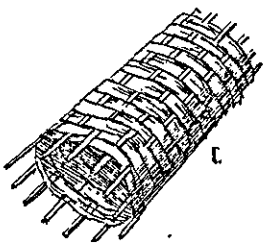
Manner in which they are planted.



where intended to be planted, the right-hand being thrust into the soft prepared soil in a sloping direction, and gently raising the back of the hand to the dotted line shown at F., the earth is then drawn forward as at G. leaving a straight bank behind the hand at H., the plant is now placed by the left-hand against the face of the bank, the collar or top of the root being held on a level with the ground, the roots are now spread out with the right-hand and the hole deepened should the length of the roots require it, the earth from G. is then brought forward with the right-hand against the roots, but not pressed, and thus the operation of planting is completed; in this way a man can plant from 400 to 500 plants daily.

27. The young plants immediately after being planted (instead of being sheltered as formerly by a screen made by bamboo branches) are covered by a cylindrical basket open at both ends, 12 inches in diameter, and 14 inches long as at I., made out of the common wattles so plentiful on these hills, one man making from 8 to 10 of such baskets daily, this is found the most efficient as well as the most economical way of protecting the plants, as when they are established the baskets can be removed and are available for further use.

And shaded.

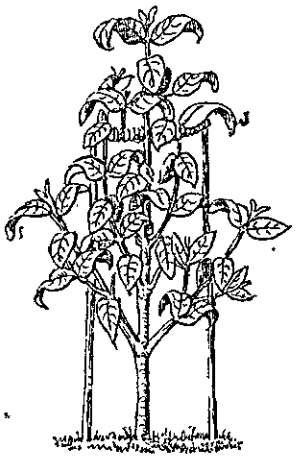


Method of shading plants.

28. It has been found that the plants when staked in the usual way are injured by the tie cutting into the bark, to remedy this, one or two stakes are placed on opposite sides at a distance of about 12 inches from the plant and a hoop formed of rattan covered with moss for large, or willow twigs for small, plants is placed around the branches and tied to the stakes at both ends when two are

Usual mode of staking the plants proves to be injurious by the ties cutting into the bark.

Adopted method of staking by which the cutting is avoided.



used as at J. In stormy situations, and steep lands, it would appear desirable, instead of staking to secure the plants to the ground by bending them forward and pegging them against the face of the hill, the plants would then throw up numerous shoots, and these shoots would protect each other from the force of the wind.

29. Cultivation under living trees has been entirely abandoned, the plants having been found to suffer from the effects of the drip, and want of light, while the roots of the trees in the neighbourhood penetrate the holes and draw up all the nourishment from the young plants; they are also liable to damage from the branches as well as the trees being broken and falling during storms.

Cultivation under shade of living trees and in the open ground.

30. Partially cleared forests have also been found quite unsuited to give shelter, as the high gales of wind being caught by the tops of the trees are driven down in strong eddies, as the current from the top of one tree meets that from another, and thus twists the plants in all directions, producing much greater injury than a steady gale. In short, the more exposed the situation in which the plants are growing, the more healthy and robust they appear, although they do not attain so rapid growth, as in more sheltered localities, thus establishing beyond all doubt, that the more the plant is exposed to light and air, the more perfectly it performs its functions, thus the juices being more effectually elaborated, we may expect a large proportion of alkaloid, which may counterbalance the comparative slower growth.

Partially cleared forests quite unsuited to the cultivation of the plants.

Plants fully exposed to light and air more perfectly perform their functions.

31. The large leaved species of Chinchona (red and grey barks) suffer considerably from high winds, especially when young, the leaves are frequently blown to pieces, and occasionally in very exposed situations the branches are broken, and the plants twisted out of the ground. As the plants grow older, their leaves become smaller and consequently not so much affected by the wind; the yellow and crown barks do not suffer so much from storms, their leaves being much smaller, they are however occasionally injured in heavy gales. The storms of hail, so frequent here in March and April, although productive of temporary damage by cutting the leaves, yet the plants have not materially suffered from this cause.

Effect of storms, and wet and dry weather on cultivation.

Plants suffer from, when young.

As attain age, less liable to injury.

ail storms break the leaves, but do no permanent damage.

32. During continuous wet weather the leaves assume a yellow tint, and become contracted around the margin towards the under surface, causing rough undulations in the texture of the leaf along the midrib and between the lateral veins. It also induces a succulent and unhealthy condition of the plant, in some instances causing an unnatural development of pith, rendering the plant liable to disease, 25 plants having died from the effects of the continued rain of last season. The grey barks suffer most from the constant stream of water thrown down their channelled leaf stalks, communicating rot to the bark, which occasionally penetrates to the stem, and thus permanently injures the plant. The heavy rains have been found to carry down a large quantity of earth, which covered the plants and caused much time to be occupied in its removal, this has been effectually obviated by a system of surface drains.

Continuous wet weather, effects of.

33. As observed by early writers "the condition of showers and sunshine" has proved most favorable for the growth and full development of the Chinchona under cultivation. The plants, however, when established bear a considerable amount of drought without injury. During the first two months of last severe dry season, the plants maintained their growth and healthy appearance, the drought then began to make itself felt, the leaves of the plants assuming by degrees the contracted form and yellow tint as during the continuous rains. After three

Showers alternated with sunshine, prove most favorable to the growth of plants.

Bear considerable drought without injury.

months continuous drought a few of the plants, on the more exposed parts of the plantation, began to droop, in a few days this tendency increased, and on the 98th day it became necessary to water the plants by the hand. These were plants of one year's growth, and probably plants of two years' growth, in good soil, would bear greater drought without injury.

98 days of continuous drought necessary to hand water young plants.

34. In collecting our samples of bark, lopping the branches or cutting down the plants to within a few inches of the ground has been found the most advantageous. Removing the bark in strips from the stems of the plants has been discontinued, for although new bark is formed over the spaces, it is not until more or less decay has been communicated to the wood, and thus the stems are prevented from expanding.

Gathering the bark and treatment of plants for this purpose.

Removing bark in strips, injures growth of plants.

35. The plants of "red," "grey," and "yellow" barks cut down between March and August have uniformly thrown strong shoots from the stools, these shoots have grown with great vigour, and this may be found a profitable way of treating the plants, particularly in exposed situations, as the number of shoots thrown from the stools afford mutual protection.

"Red," "grey," and "yellow" barks throw out shoots from the stools when cut down between March and August.

36. It is, however, important to note that of the plants cut down between September and February (although of the same species) not one in five threw shoots from the stools; of these plants, two retained life for a few days then gradually died away. The varieties of "crown" barks, however, form an exception, as these possess sufficient vitality to produce strong shoots at whatever season of the year they are cut.

But not when cut between September and February.

"Crown" barks an exception, as they throw shoots at any season.

37. From the above it is obvious that if the harvest of bark is to be obtained by cutting down the plants in the dry season, or between December and March, they must be prepared during the preceding wet weather, as described and illustrated at paragraph 21, Plate VI in "Notes on cultivation, &c., dated March 1863."

If cut during dry weather, plants must be prepared.

38. When the system of lopping and pruning is adopted, all the species are found readily to produce fresh branches at any season of the year.

Lopping and pruning adopted, species readily produce fresh branches.

1
C-101

From 1867. No. G.C. No. 6309
45

To The Secty of Govt
N. W. Provs

Dated 13th February Camb
Despatched 16th Yeddiyoor
Received 5/2

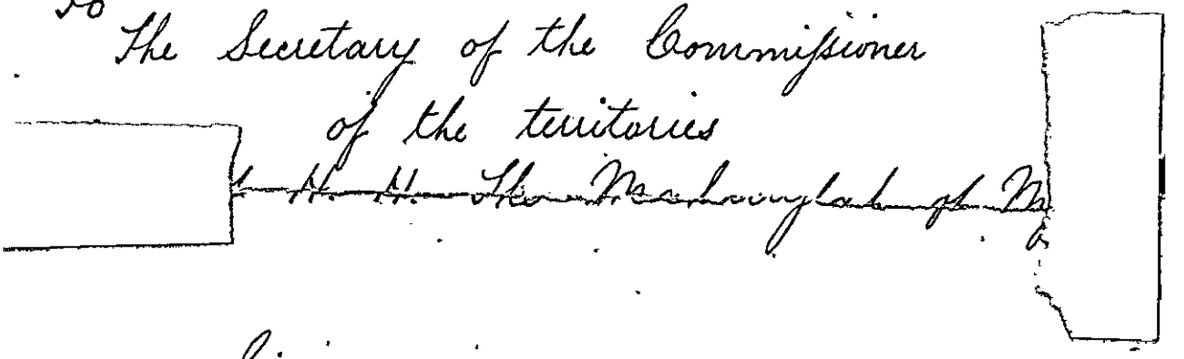
Enclosures No.
General No. 6309
Revenue No. 45
} 186-6

Acknowledges and
credits Examiner the receipt
of the Official Extracts from the Reports
on the Govt Cinchona
Plantations and Botanical
Gardens for 1863/64 and 1864/65
forwarded with Memo:
dated 31st January 1867.

C. 15.2.67 Cmy.
Copy Comm

Badamaney. 5l 3
March 27th. 1867.

To The Secretary of the Commissioner
of the territories
~~H. H. The Maharajah of Be~~



Sir,

I have the honour to request that you will be good enough to inform me whether I can be supplied with Cinchona Plants from the gardens at Bangalore. as the Badamaney Coffee Company Limited wishes to give them a fair trial on this property.

I may add that the Ceylon Government supplies Planters free of all charge save the cost of transport.

I have the honour to be
Sir.
Your most obedient Servant

J. S. Middleton

1867 No. 601.

From

J. L. Middleton Esqr.
Cadamany.

D/. 27th March
Recd. 2nd April
Regd. 2nd ditto

Requests to be obliging-
-ly informed if he can be
supplied with a few
Cinchona Plants from
the Gardens at Bangalore
as the Cadamany Coffee
Co. is desirous of giving
them a fair trial on their
Property, & adds that the
Ceylon Govt. supplies
Planters free of all charge
save the Cost of transpos

~~Gl No 129~~ 1867/68.
Gl No 21

M. C. O

Bangalore 5th April 1867

Sl. 4. J. S. Ruddlestone Esq
Cardamum Agy
Tinnyvelly

Sir I am directed by the Government to acquaint you in reply to your letter of the 29 Inst. that the Cinchona plant has been taken charge of by the Dale Sagh at Bangalore, and I suggest that you should apply either to the Dr Superintendent Lieut. Col. Sir Ross Porter the Supt of the Govt Cinchona Plantation ~~at Nedivattum~~ at Pantaravary, whence it may be forwarded packed & forwarded you with supply of cuttings.

Mrs Lt Col Sir

C 233.

1867 No 1.29/21

To

J. L. Middleton Esqr

Cadamunny

Immigration

Dy 4 April 1867

Govt Nos 129/21 1867. 68

Intimates in reply to his letter of the 27 Ultimo that the Chinchona plant is not reared at the Lall Bagh and directs him to apply either to the Dy Supdt of Cudoor or to Mr. Ross Porter the Superint. of the Govt Chinchona Plantation at Sanitawary for the Cuttings required by him

No 55

1
6 — 33

G. C.

1867 No. 14

From The Superintendent
Nuggur Division

To The Secretary to the
Commrs of Mysore

Dated 25th April 1867
Despatched 29 —
Received & Regd 2d May

Enclosures None

General No. 41 } 1867-68.
Genl. No. 14

Requests that he may be supplied with 3 copies of printed Memo: on Cinchona plantation by Major C. Elliot C. B. as also of the printed pamphlet received from the Revenue Board Madras.

Office Abbay
Are these available?
Comm.r
The 3 applied for are available
Forwarded
Issued Hopkins 4/5/67

Revenue Department

No 2 516

To

The Commissioner for the
Government of the Territories of
His Highness the Maha Rajah of Mysore.

Sir,

I am directed to forward for your information copies of the undermentioned papers.

Report of the Commissioners appointed to test the efficacy of Chinchona Alkaloid dated 28th February 1867.

Report of Mr. Broughton, Quinologist on the results of his examination of the various products of the Government Chinchona Plantations, dated 1st April 1867.

Further Report of Mr. Broughton on the same subject, dated 13th July 1867.

I have the honor to be
Sir,
Your most Obedient Servt

Secretary to Govt

Fort St. George
3rd August 1867.

1867 No. 107

From

The Secretary to Government
Revenue Department
Fort Saint George

Dated 3d August
Read. 5th "
Reply 6th "

No 2.

Forwards copies of papers regarding the Chinchona Alkaloids for information

With copy of this letter
The Enclosures may
be circulated for
perusal to the Board
& the returned cover
to this Office for reg.
5.8.67

No 5.

Proceedings of the Madras Government, Revenue Department, 19th March 1867.

Read the following papers :—

No. 302. From the President and Members of the Chinchona Commission, to the Secretary to Government, Revenue Department, Fort Saint George, dated Madras, 28th February 1867.

1. With reference to the Order of Government, as per margin, we have the honor to report that the printing of the tabulated results of the experimental use of Chinchona Alkaloids has occasioned some delay in the submission of a progress report. A considerable number of the tables, however, have now been printed, so as to enable us to estimate, with tolerable precision, the therapeutical effects of the several alkaloids; and, as our President will have no other opportunity of recording his views as to the usefulness of these medicines, the Members of the Commission have decided to conclude now a preliminary report of their proceedings, leaving their more detailed observations to follow when the results of the experiments still in progress are more fully known.

No. 764 of 28th March 1866.

2. In the Tabular Statements, already printed and laid before the Commission, minute particulars in regard to 1,145 cases of paroxysmal fevers treated either by Chinchonine, Chinchonidine, or Quinidine, have been registered. These fevers have occurred mostly at stations notedly malarious, such as at Goodaloor in the Wynaad; Sumblepoor and Russelondah in the Northern Circars; the Godavery jungles; Mysore, Cochin, and Labuan, and may, therefore, be regarded as fair average types of the forms of paroxysmal fever to be met with in the malarious districts of Southern India.

3. A larger number of cases have been treated up to date, but the Returns have not yet been received, or, if received, are not out of the printer's hands, so that the results must be considered in detail hereafter.

4. With regard to the 1,145 cases of fever referred to, it will suffice to note that they were treated by the alkaloids, as follows :—

By sulphate of	Chinchonine	... ...	410
Do.	Chinchonidine	... ...	359
Do.	Quinidine	... ...	376

The doses and mode of administration varied a good deal. Some Medical Officers used large doses of from 15 to 20 grains; others, medium doses of from 8 to 10 grains, and some small doses of from 2 to 5 grains. As a general rule, the Members of the Commission are of opinion that the experiments were most successful when medium doses were employed, that is, the cases of fever in which 8 or 10 grains of alkaloid were administered in a single dose daily, appeared to recover more expeditiously than where larger or smaller quantities were employed. Large doses of Chinchonine, Chinchonidine, and Quinidine produce effects very similar to those of Quinine. Disagreeable noises in the head, singing in the ears, deafness, and giddiness are the more noticeable of the symptoms produced by all of the Chinchona alkaloids. Vomitting, nausea, and purging also are occasionally noted to follow their use. On the other hand, small or moderate doses produce none of

these peculiar effects, while they improve the appetite, strengthen the digestion, and, in many cases, appear to have a marked effect in reducing the size of congested spleens.

5. The alkaloids were exhibited successfully, that is, with the result of a rapid cessation of febrile paroxysms in a very large proportion of the cases. Out of the 1,145 cases recorded, four deaths occurred, and all these took place at Goodaloor, in Wynaad. Dr. Keess observes of them, that the fever was complicated either with Pneumonia or Diarrhœa, and that a great proportion of his patients were half-starved, emaciated persons, completely prostrated by the malarious influences surrounding them.

In addition to the cases ending fatally, it is recorded that the alkaloids failed more or less to arrest febrile paroxysms in twenty-seven persons—a proportion a little in excess of two per cent. of the total cases treated.

6. In regard to these failures, it must be noted that they occurred chiefly in the practice of gentlemen who tried the alkaloids, not in recent attacks of fever, but in patients whose systems were chronically poisoned by malaria. Thus, Mr. Walters, of the 4th Regiment N. I., Secunderabad, records of many of his cases, that they had been from one to three or four months suffering from fever before he used the alkaloids, and that in some of them Quinine failed just as much as Quinidine, Chinchonine, or Chinchonidine had done. Mr. Chipperfield explains the probable cause of failure in his Report (Appendix III). In recent attacks of uncomplicated paroxysmal fever, the new alkaloids appeared to most of the Medical Officers using them, and to the Members of the Commission, to be quite as efficacious in the curing of fevers, as Quinine. On this subject, however, it is impossible to speak with precision, until the results of treatment with the chemically pure di-sulphate of Quinine, as supplied by Messrs. Howards, have been tabulated in the form used for recording the treatment by the other alkaloids. Instructions have been issued to the gentlemen engaged in the experiment to do this, and the returns, when received, will afford most valuable data whereby to compare the relative therapeutical effects of the several alkaloids.

7. The evidence, so far as it has come before the Commission, does not go to shew any particular superiority of one alkaloid over another.

The sulphate of Quinidine is, perhaps, the one regarding which there is the least difference of opinion as to its merits. All three are undoubtedly anti-periodic, and capable of controlling paroxysmal fevers. The sulphate of Chinchonine in *large* doses perhaps causes more unpleasant symptoms than the others; but on this point further evidence is still wanting to enable the Commission to offer a positive opinion. As regards the general and practical question at issue, we agree with

Dr. Keess in thinking that all three alkaloids are, equally with Quinine, capable of controlling paroxysmal fevers. Dr. Keess' experience led him to conclude that a 10-grain dose of either salt, would check or postpone the febrile paroxysm in a considerable number of cases, while very few patients required more than a second 10-grain dose to subdue the disease for the time being.

Other observers have employed larger quantities of the several drugs; but it is by no means clear to the Commission, that the quantities exhibited were, in all cases, necessary to check the fever. As regards this part of the inquiry, it is intended to institute a distinct series of experiments for the more accurate comparison of the value of the several alkaloids, when contrasted with Quinine, or with each other.

8. The main conclusion which the Members of the Commission have derived from the data before them, is that the alkaloids hitherto but little valued in medicine, are scarcely, if at all, inferior as therapeutical agents to Quinine.

What the exact differences may be in their physiological and therapeutical action, is a question the answering of which may fitly be deferred until more data have been collected in reference to the new alkaloids. The differences, however, will most likely be found to be of degree, rather than of kind, and practically, so far as the wants of India are concerned, it will be just as well that the locally grown barks yield a large proportion of one alkaloid as of another.

9. So impressed are we of the value of these hitherto despised alkaloids, that the Members of the Commission are unanimous in considering that, in the public service of this country, they may very advantageously be substituted in part for Quinine. If three pounds of Chinchonine can be obtained at the price of one pound of Quinine, we consider that a great public good would result from the purchase of the larger quantity, as it would enable the Officers of the Medical Department to benefit a much larger number of the population than they can now afford to treat by prescribing Quinine. Arrangements will be made by Dr. Mackenzie to include in the next Medical Indent on the Home Government a requisition for suitable quantities of each alkaloid.

10. We beg to direct attention to the tables, &c., in the Appendix. It gives us much pleasure in testifying that the experiments conducted by Dr. Keess at Goodaloor have been most carefully recorded.

11. Mr. Cornish, Secretary to the Principal Inspector General, in addition to his other duties, voluntarily undertook those of Secretary to the Commission. For the mode in which these duties have been carried out, the Members of the Commission feel that their best acknowledgments are due to that gentleman.

APPENDIX I.

TABLE 1.—*Shewing the results of treatment of paroxysmal fevers by Chinchonine.*

	Name of Medical Officer.	District.	Type of Fever.			Results.		Remarks.
			Quotidian.	Tertian.	Remittent.	Cured.	Failed.	
1	Dr. Keess and Mr. Wade.	Goodaloor (Wynaad) ...	170	19	1	188	2*	Large doses produced disagreeable effects; usual dose from 5 to 10 grains daily. Dr. Keess considers the remedy equal to Quinine.
2	,, Foy	Sumbulpore	31	6	1	38	...	Chiefly, 5-grain doses from two to three times daily.
3	,, Cleveland	Mysore...	38	4	2	43	1†	Dose grains v—xx three times a day. Chinchonism resulted when large doses were given.
4	,, Whitton	Cochin...	25	3	...	28	...	Single dose of 10 grains in a few. In most 5 grains before expected paroxysm. Remedy appeared to effect rapid reduction of size of spleen in several cases.
5	,, White, 1st Royals ...	Kamptee	6	...	...	6	...	Small doses of 2 or 3 grains used. Had larger doses been given, the cure would have been more rapid.
6	,, Dougall	Northern Circars ...	14	2	...	16	...	Given in v, x, and xv grain doses.
7	,, Chipperfield	Madras...	8	2	1 Contd.	8	3*	In unsuccessful cases the remedy was not continued more than two days, small doses only given.
8	,, Heard...	Shemogah, Mysore ...	2	...	...	2	...	
9	,, Walters	Secunderabad	18	3	...	17	4	Nearly all Dr. Walters' cases had been a long time under other treatment before Chinchonine was resorted to. They were obstinate intermittents, and did not yield readily to treatment. Many of the cases had "burning of the hands and feet."
10	,, Fitzgerald	Labuan	14	5	...	19	...	Small doses used which rendered treatment protracted.
11	,, Houston	Upper Godavery ...	35	...	...	35	...	Chinchonism resulted when repeated large doses were used. Dr. Houston notes that, in the majority of cases, the pulse rose soon after taking a dose of the medicine.
			361	44	5	400	10	
		Total...	410			410		

* Both died from exhaustion.

† Complicated with pneumonia—the remedy was discontinued.

TABLE 2.—*Shewing the results of treatment of paroxysmal fevers by Chinchonidine.*

	Name of Medical Officer.	District.	Type of Fever.			Results.		Remarks.
			Quotidian.	Tertian	Remittent.	Cured.	Failed	
1	Dr. Keess and Mr. Wade...	Goodaloor	137	16	1	154	...	These cases were nearly all cured by from one to two doses of 8 or 10 grains.
2	,, Foy	Sumbulpore ...	36	5	...	39	2	In the cases of failure Quinine was resorted to, but the result is not stated—generally used in 5-grain doses.
3	,, Cleveland	Mysore	24	10	4	38	...	Doses varied from v to xx grains—small doses in a few cases with less immediate effect.
4	,, Whitton	Cochin	28	4	...	31	1*	
5	,, White, 1st Royals ...	Kamptee	...	...	...	...	...	
6	,, Dougall	Northern Circars ...	12	3	...	15	...	Given in v, x, and xv grain doses, considered by Dr. Dougall quite equal to Quinine.
7	,, Chipperfield... ...	Madras	8	3	1	7	5	Three of the unsuccessful cases were only one day under treatment. See Dr. Chipperfield's remarks in Appendix III.
8	,, Heard	Shemogah, Mysore ...	11	...	...	10	1	Grains 8 to 10 before paroxysm.
9	,, Walters	Secunderabad ...	7	1	...	5	3	As regards three cases the results are so vaguely given, that it cannot be said whether the remedy failed or not.
10	,, Fitzgerald	Labuan	18	4	...	22	...	Grains 3, 6, 8, before paroxysm.
11	,, Houston	Upper Godavery ...	25	1	...	25	1†	
			306	47	6	346	13	Three doubtful.
		Total...	359			359		

* Fever became remittent.

† Complicated with Neuralgia and Paralysis.

TABLE 3.—*Shewing the results of treatment of paroxysmal fevers by Quinidine.*

	Name of Medical Officer.	District.	Type of Fever.			Results.		Remarks.
			Quotidian.	Tertian.	Remittent.	Cured.	Failed.	
1	Dr. Keess and Mr. Wade...	Goodaloor	140	11	2	151	2	Both died, one from exhaustion, one dysentery.
2	,, Foy	Sumbulpore, ...	37	6	...	42	1	Chiefly 5-grain doses, three times a day.
3	,, Cleveland	Mysore	28	5	...	33	...	2 cases result not known. From 2 to 20 grain doses, 3 times daily.
4	,, Whitton	Cochin	26	3	...	29	...	Chiefly 5-grain doses. In a few cases 10 grains.
5	,, White, 1st Royals ...	Kamptee	9	...	...	9	...	3 and 5-grain doses, three times daily.
6	,, Dougall	Northern Circars ...	11	4	...	14	1*	5, 12, and 15 grain doses.
7	,, Chipperfield	Madras	8	...	...	8	...	5-grain doses, thrice daily.
8	,, Heard...	Shemogah, Mysore ...	12	...	2	12	2†	Doses 2, 4, 5, and 6 grains.
9	,, Walters	Secunderabad	15	1	...	14	2	Some of the cases were successfully treated, hypodermically. The two failures cured by Quinine.
10	,, Fitzgerald	Labuan	9	1	...	10	...	6-grain doses.
11	,, Houston	Upper Godavery... ...	10	1	1	12	...	Grains v to x, twice a day.
12	,, Henderson	Bangalore...	15	...	...	12	3‡	
13	,, Oswald	Do.	17	2	...	19	...	Grains v to x, chiefly in interval of fever.
			337	34	5	365	11	
		Total...	376			376		

* In this case paroxysm only mitigated not checked.
† These were cases of remittent fever, and remained under treatment though benefited.
‡ Remedy omitted on account of diarrhœa.

APPENDIX II.

Report on the Chinchona Alkaloids.

1. In obedience to instructions received from the Head of the Medical Department, I proceeded to Goodaloor, south-east Wynaad, and started the alkaloids experiment on the 1st June 1866.

2. When I arrived at Goodaloor, fever was prevailing to a great extent, both there and in the adjoining coffee estates. Owing to the great rush of fever subjects to the Dispensary, I decided on first observing the effects of large doses of the alkaloids.

3. As there were many persons suffering from fever in June, the administration of a single large dose enabled me to take up a larger number of cases, than I would have been able to do, had I begun with small and repeated doses.

4. I first tried Chinchonidine, in doses varying from 10 to 15 grains, and, in a few days, I was pleased to find that it acted as Quinine would have done in similar doses.

5. I next tried Quinidine with similar results.

6. I left Chinchonine to the last, as it was said to be an irritant of the gastro-intestinal mucous surface. I was, however, agreeably disappointed, when I found that it did not cause nausea or vomiting in doses of 10 grains, and that it was as good an anti-periodic as the sister alkaloids.

7. Encouraged by the absence of symptoms indicating gastro-intestinal irritation, I used Chinchonine in fever complicated with diarrhœa, and I am satisfied that it is not an irritant of the stomach or bowels any more than Quinine is, in certain cases.

8. Some of my patients were *out* and *in*-patients of the Goodaloor Dispensary. Others were visited in the bazaar, and in the adjoining coffee estates, from two to six miles distant from Goodaloor.

9. The great majority of my patients were half-starved, emaciated persons, with flabby muscles, dry, dirty, and shrivelled skins, large spleens, bloodless eyes and tongue, and small atonic pulse. In many of them, languor was so marked that they could, with difficulty, muster up energy enough to reply to questions; and so prostrated were some of them, that they were, with difficulty, induced to take the medicines offered to them.

10. I have not attempted to reduce, to a small compass, the results set forth in the tabular reports, as I hear that this work has been undertaken by the Chinchona Commission; but I beg leave to point out that a 10-grain dose, of all three alkaloids, seemed sufficient to check the return of fever in the majority of cases. Where it failed to check the return of fever, the succeeding paroxysm was generally observed to be less severe. When the paroxysms returned with unabated severity, 15 grains, and then 20 grains were tried. In a few severe cases, I administered, at the onset, 15 or 20 grains.

11. During the four months that I was employed in the Wynaad, 467 cases were treated with the alkaloids. The majority of these were cases of the quotidian type. Bronchitis, congestion of lungs, pneumonia, diarrhœa, dysentery, and anasarca were occasional complications. I may as well add, that these complications did not in the least interfere with the administration of the alkaloids. Where the local affection required special attention, the alkaloids were given with remedies suitable to the complication. I may here add that all three alkaloids appeared to be as efficacious as quinine.

* * * *

MADRAS,
25th February 1867.

(Signed) J. KEESS, M.D., Assistant Surgeon,
Late on special duty in the Wynaad.

APPENDIX III.

Report on the therapeutic effects of the Salts of the Chinchona Alkaloids.

1. In furnishing the accompanying tabular reports of the therapeutic effects of the Chinchona Alkaloids, as tested at the General Hospital, Madras, I have the honor to state, that in order to draw a more accurate comparison between the salts tested and the di-sulphate of Quinine, I exhibited the former in the same way as I am in the habit of using the latter, viz., I gave the first dose upon the decline of the sweating stage, the second and third doses being given at two-hour intervals. The fourth dose was exhibited at the same hour as the first dose, and so on with the fifth, sixth, and any subsequent doses which appeared to be required.

2. I have been led to form a high estimate of the anti-periodic effects of the sulphate of Quinidine. This salt was successful in the cure of the eight cases in which it was administered, and it appeared to me to be quite as valuable a remedy as the di-sulphate of Quinine itself. In some respects it seemed superior to Quinine, as in no instance did it produce any of the disagreeable effects termed Chinchonism ; in fact, two patients who were suffering from severe headache, stated that the medicine completely relieved this symptom. I did not observe any injurious effects upon the digestive organs, but rather a favorable action, as appetite was promoted and digestion apparently assisted. In seven cases the Quinidine was given in doses of five grains thrice daily. As these doses were effectual, I continued them. But, as a matter of experiment, in case 8, I gave on the 11th of June, one dose of 15 grains on the decline of the sweating stage, and a second dose of 8 grains two hours before the next expected paroxsym. The patient was free from fever for five days, when a relapse occurred. The same plan of administration was followed and with success, for there was no further paroxysm of ague, although the patient remained under observation for Incipient Phthisis, for a period of more than a month.

3. The sulphate of Chinchonine I would place second on the list as an anti-periodic. It was unsuccessful in three out of eleven cases ; but two of these werevery unfavorable ones. One, a European Coffee Planter was suffering from Tœnia and general abdominal engorgement, and the remedy could not be pushed in his case, as it produced Chinchonism very rapidly. He had taken a large quantity of Quinine before the Chinchonine was commenced. He was subsequently treated with Pernitrate of Iron, Kuosso, Turpentine, and oil of Male Fern, but he did not pass the head or neck of the Tœnia, only a few proglottides. I saw him on September 17th very much improved in health, getting strong and stout, and quite free from fever. The second case, a European (Surgeon of the Ship "Blackwall,") was a relapse. Three weeks previously he had been cured of an intermittent by Quinidine. (Case 7 in the table.) He was then suffering from Chronic Hepatitis, and had threatenings of Hemiplegia. These symptoms quite disappeared before his first discharge from Hospital on the 19th June. On his second admission it was ascertained that he had been much exposed to the sun, going forwards and backwards among the shipping in the roads. The Chinchonine* failed to arrest the paroxysms of ague, which was subsequently effected by Quinine.

4. The third unsuccessful case was that of a Eurasian lad, whose stomach would not tolerate the remedy. He was subsequently cured by a combination of Diaphoretics with Quinine.

5. Gastric disturbance was produced by the Chinchonine in most of the successful cases.

6. The sulphate of Chinchonidine appears to me a much inferior anti-periodic to Quinine. It was unsuccessful in five out of twelve cases in which it was employed. I allowed myself to be somewhat prejudiced against the salt when I commenced its use, as it almost always produced nausea.

7. In cases 1, 8, and 9, it was decidedly successful. Case 2 might be removed from the table ; the man was saturated with malaria, and had previously been treated by Quinine and by Chinchonine.

8. Case 3 was a complicated one ; the woman was the subject of Hysteria, and each cold stage was accompanied by violent hysterical fits. Her spleen was much enlarged, and, altogether, it was a most unfavorable case for even Quinine. Deobstruents were freely used, even whilst

* Only 3ss. given.

taking the Chinchonidine. She is entered as having been successfully treated by the Chinchonine (Case No. 10 in the table). The fact is, there had been no paroxysm for two or three days whilst taking the Chinchonine, and as that salt was exhausted, she simply passed to the Chinchonidine. She has since had relapses, and has been treated by Quinine and Deobstruents. She was discharged at her own request on the 31st August, but since then has had a relapse and has again come under treatment.

9. Case 4 might be removed from the table; he had only one dose of Chinchonidine which increased mental delusions as Quinine had done before. He is still under treatment, occasionally getting a paroxysm of ague with very profuse sweating. He is improving under mineral acids, and his distressing mental delusions have disappeared.

10. In case 5, the remedy produced violent vomiting, and it was discontinued at the patient's request. The same remark may be made as to Case 6, subsequently cured by Quinine. Cases 7 and 12 were very mild cases, which would probably have been easily cured without any Chinchona preparation. In case 10, nine grains of Chinchonidine appeared to prevent the recurrence of a paroxysm. The patient, a very anæmic female, was subsequently cured by ferruginous remedies.

MADRAS,
18*th September* 1866.

(Signed) W. N. CHIPPERFIELD, Assistant Surgeon,
Acting Physician, General Hospital.

No. 303. From the Inspector General, Medical Department, to the Secretary to Government, Revenue Department, dated Fort Saint George, 9th March 1867, No. 84.

1. In continuation of this Office letter No. 372, of 11th October 1866, I have the honor to forward, for submission to the Home Government, a copy of each of the tabulated reports received printed since that date, of the therapeutic effects of the Chinchona alkaloids received from England for experimental trial.

2. The Report and tabulated statistics, received up to the end of February by the Chinchona Commission, have already been submitted to Government.

LIST.

	Chincho-nine.	Chinchoni-dine.	Quinidine.	Chinchona leaves and bark.	Report.
Dr. Chipperfield, General Hospital, Madras	1	1	1	...	1
Dr. Cleveland, Mysore	1	1	1	...	...
Dr. Dougall, Northern Circars ..	2	2	2	...	...
Dr. Fitzgerald, Labuan	2	2	1	...	...
Dr. Foy, Sumbulpore	3	3	3	...	...
Dr. Heard, Shemogah	2	2	2	...	...
Dr. Henderson, Bangalore	...	1	1	...	...
Dr. Houston, Doomiguidiem ...	3	2	2	1	...
Dr. Keess, Goodaloor (Wynaad.)	3	3	3	1	1
Dr. Oswald, Mysore	...	...	2	1	...
Mr. Wade, Goodaloor (Wynaad.)	...	1	2	...	...
Dr. Walters, Secunderabad ...	3	3	2	3	...
Dr. White, Kamptee...	1	...	1	...	...
Dr. Whitton, Cochin	2	1	2	1	1
Dr. Miller, Thyetmyoo	...	...	1	...	...

Proceedings of the Madras Government, Revenue Department, 19th March 1867.

No. 304. ORDER THEREON, 19th March 1867, No. 652.

Miscellaneous.

1. Ordered that these papers be transmitted to the Secretary of State.

2. This preliminary report of the Members of the Chinchona Commission on the results of the experimental use of the Chinchona alkaloids is very satisfactory and encouraging.

(True Extract.)

(Signed) W. HUDLESTON,
Secretary to Government.

To the President and Members of the Chinchona Commission.
,, the Principal Inspector General of the Medical Department.
,, the Superintendent Government Chinchona Plantations.
,, Mr. J. Broughton, Government Quinologist.

Exd. S. T. Augustin.

No. 206. Read the following letter from J. BROUGHTON, Esq., Quinologist, to Government, to the Secretary to Government, Revenue Department Fort Saint George, dated Ootacamund, 2nd April 1867 :—

1. I have the honour to enclose a preliminary report on the Chinchonæ of the Government Plantations.

2. I would request permission to proceed on duty to Madras on the arrival of the Government vessel containing my laboratory stores, in order to superintend personally the transit of the same to this place. Any damage to the apparatus would seriously impede my future work.

From J. BROUGHTON, Esq., Quinologist to Government, to the Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 1st April 1867.

1. I have the honour, in the subsequent pages, of submitting such part of the results of my examination of the various products of the Government Chinchona plantations, that possess sufficient interest and definitiveness to be brought under the notice of Government.

Present want of Chemical appliances.

2. This examination has been conducted under considerable difficulties, arising from the want of many of the chemical appliances which are requisite for the analysis of Chinchona barks. Notwithstanding the kind assistance I have received from Mr. McIvor and Mr. Batcock on all occasions when the establishment at the Botanic Gardens could supply my wants, much time has been consumed in improvising substitutes for lacking implements, and in making such arrangements as are incident to a new establishment.

C. Succirubra.

3. The greater part of my attention has been devoted to an examination of C. Succirubra. Of all the species yet naturalized in India, this exhibits the most vigorous growth. It is numerically the most important since, nearly 800,000 plants are now growing in the several plantations. It is, moreover, the bark of this kind that will first find its way into actual consumption. For these reasons the products of the Red Bark trees and the conditions of their occurrence merit an early and careful study.

Marked differences in habit of individual trees.

4. A slight inspection of the more advanced portions of the plantations at Neddivuttum reveals considerable differences in the habit and appearances of the individual Red Bark trees. This has already been remarked by Mr. C. R. Markham, who suggested that these variations in the colouring and habit of the trees might probably be connected with differences in their yield of alkaloids. The accuracy of this conjecture is rendered evident by the results of the analyses of the trunk bark of four trees, which are calculated in per-centages of dry bark, as given below :—

Statement of analyses.

	I.	II.	III.	IV.
Total alkaloids (hydrated)	4·85	7·00	6·40	6·4
Alkaloid soluble in Ether (Quinine)	3·25	4·25	4·75	1·7
Chinchonidine and Chinchonine	1·60	2·75	1·65	4·7
Sulphate of Quinine obtained crystallized...	3·00	4·00	4·55	1·7

In the above analyses, as well as those given subsequently, the sulphate of Quinine has been obtained in as pure a state as possible.

Remarks on analyses of Red Barks.

5. Of No. I., it may be remarked that though the poorest specimen that has come under my notice, it gives at least an equal yield to the best Ecuador Red Barks. Nos. II., III., and IV.

are considerably richer. Seven per cent. of alkaloids in the natural (unmossed) bark appeared to me so large an amount that I was led to repeat the analyses by a different method, which, however, closely corroborated the former results. No. II. owes its richness in alkaloids to the presence of an unusually large amount of Chinchonine, which crystallized from an alcoholic solution with the greatest readiness. No. IV. contained comparatively but a small amount of Quinine, but in its stead a large amount of Chinchonidine, which easily yielded a sulphate not distinguishable by the eye from that of Quinine. In this sample of bark the total quantity of crystalline sulphates obtained was no less than 5·2 per cent. of the weight of the dry bark. All the barks contain a certain amount of quinine apparently not susceptible of crystallization.

Bark of branches.

6. These analyses were made in all cases with the bark of the trunk, which (doubtless on account of superior age) is much richer than that of the branches yielding "quill bark." Some of the latter, which I examined, yielded but three per cent. of alkaloids, from which 1·4 per cent. of crystalline sulphates was obtained.

Yield of alkaloids in bark still probably increasing.

I am of opinion that the foregoing data, compared with those of Mr. Howard's earlier reports, afford grounds for believing that the amount of alkaloids in the barks is still on the increase.

Considerations affecting value of Red Barks,

7. It should be stated that the richness of the Red Barks in alkaloids, though doubtless entitling them to the first place among our Indian barks, is not in many respects a true measure of their intrinsic value for manufacturing purposes. This value depends also on the readiness with which the Quinine, &c., can be obtained in a pure and crystalline form. In this respect the natural unmossed Succirubra bark is at some disadvantage, since its alkaloids are more difficult to obtain in a pure form than those yielded by some other kinds.

Mossed Red Bark,

8. Mr. McIvor's valuable and interesting method of treatment of the barks by mossing has already been fully described by himself. Unfortunately I was unable to obtain a specimen of bark that had been under this treatment for more than six months. A sample of bark of a tree of four years and a half old, renewed under moss, yielded (in per-centages of dry bark) :—

Analyses of mossed renewed Bark,

Total alkaloids (hydrated) ...	7·10 per cent.
Alkaloid soluble in Ether (Quinine)	3·95 ,, ,,
Chinchonine and Chinchonidine	3·15 ,, ,,
Crystallized sulphate of Quinine obtained	3·45 ,, ,,

9. In this instance the comparative youth of the renewed bark does not permit me to quote so high a per-centage of alkaloids as that found some time since by Mr. Howard in bark that had been longer under treatment.* Nevertheless, the advantages of the mossing process applied to this bark, makes itself at once evident to the worker by the readiness and purity with which the sulphates crystallize. The amount of the latter would be much larger had sulphate of Chinchonidine been included.

Root Bark,

10. An examination of the root bark of C. Succirubra enabled me to corroborate the statement of Dr. De Vrij that it contains a large amount of alkaloids.

The dried bark yielded—

Total alkaloids (hydrated)	6·0 per cent.
Alkaloid soluble in Ether (Quinine)	2·15 ,,
Chinchonidine and Chinchonine	3·85 ,,
Crystallized sulphate of Quinine obtained	2·00 ,,

* Government Return, 1866, p. 134.

Remarks on analyses.

From the above it appears that the greater part of the alkaloids in this root-bark consists of Chinchonidine and Chinchonine. The former alkaloid occurs in considerable quantity. In no case, however, could the roots be a remunerative source of alkaloids, since their bark is thin, contains 74 per cent of water, and is laborious to procure.

Leaves of C. Succirubra.

11. The occurrence of alkaloids in the leaves of the Chinchonæ has been the subject of numerous and conflicting statements. In order to enquire into this interesting and important point, I worked with four lbs. of the leaves of C. Succirubra.* From these I succeeded in obtaining 3·1 grains of alkaloid, of which about 1 grain was soluble in Ether, and gave a faint indication of Quinine when tested with Chlorine water and Ammonia. From none of the alkaloid obtained from the leaves was I able to obtain a definite crystalline sulphate or oxalate.

Probable value of leaves.

Though I would refrain from advancing a decisive opinion until I have examined the leaves at another period of the year, it appears to me to be probable, from the above examination, that the leaves of C. Succirubra (even in the fresh green state) are worthless as a source of febrifuge alkaloids. They appear to owe their bitterness to the presence of Quinovin, a substance which may probably possess some tonic qualities.

C. Officinalis.

12. Next to the C. Succirubra the most important species we at present possess is the C. Officinalis, whose varieties yield the Crown Barks. The three varieties, *Bonplandiana*, *Uritusinga*, and *Crespilla*, greatly resemble one another, and appear to differ even less among themselves than some individuals of C. Succirubra, of which Botanists recognize but one variety.

Var Bonplandiana.

Of these varieties, *var Bonplandiana* is the most important, since upwards of 750,000 are now growing on the plantations. This variety also comprises the most advanced trees, whose identity with their name could be considered certain. The trunk bark of a tree from Dodabetta plantation yielded in the dry bark the following per-centages:—

Analyses of Crown Bark.

Total alkaloids (hydrated)	3·6 per cent.
Alkaloid soluble in Ether (Quinine) ...	2·8 ,, ,,
Chinchonine and Chinchonidine ...	0·8 ,, ,,
Sulphate of Quinine obtain crystallized	2·8 ,, ,,

The fresh bark contained 66 per cent. of water.

A second specimen of somewhat different habit yielded—

Total alkaloids (hydrated)	3·8 per cent.
Alkaloid soluble in Ether (Quinine)	3·0 ,, ,,
Insoluble in Ether (Chinchonine)...	0:8 ,, ,,
Crystallized Sulphate of Quinine obtained	2·9 ,, ,,

Value of Crown Bark.

Hence it appears that even at their present age the trees of C. Officinalis *var Bonplandiana* yield a bark of admirable quality, and nearly equal to the fine Calisaya bark of Bolivia. In the last quoted analysis no alkaloids were found, except Quinine and Chinchonine, the latter occurring

* The method of proceeding adopted was as follows:—The bruised leaves were boiled in a chattie with water acidulated with Sulphuric Acid, and the bitter greenish decoction was separated by drainage and strong pressure through a cloth. It was then concentrated by evaporation, allowed to cool, and made strongly alkaline by the addition of milk of lime. A considerable precipitate was thus obtained, which was separated by filtration, and purified by careful washing; then dried at 200 F and powdered. This powder was then repeatedly boiled with strong spirit, and the alcoholic extracts evaporated to dryness. The residue consisted mainly of a bitter yellow resin. It was boiled with acidulated water (by which but a small proportion dissolved) and filtered. The solution was then made alkaline with Caustic Soda and shaken up in a separator with Chloroform. The Chloroform was then separated, and being evaporated by a gentle heat in a capsule, left the purified alkaloid as residue.

in but small quantity. I am of opinion that this bark possesses, for manufacturing purposes, certain advantages over the Red Bark, that in some measure tend to compensate for the smaller yield and slower growth of the tree producing it. The Crown Bark yields its alkaloids with greater ease, owing to the small amount of resin and colouring matter with which they are associated.

Mossed Crown Bark.

13. An analysis of similar bark that had been renewed six months under moss yielded—

Total alkaloids (hydrated)	6·8 per cent.
Alkaloid soluble in Ether (Quinine)	4·8 ,,
Chinchonine and Chinchonidine	2·0 ,,
Sulphate of Quinine obtained crystallized	4·1 ,,

Increased yield produced by mossing.

This analysis shews that the mossing process, though only applied for six months, has greatly increased the yield of alkaloids in this variety of bark.

14. I would here beg permission to state, without advancing any new hypothesis, such known facts that appear in a great measure to explain the increased amount of alkaloids produced by mossing the bark.

Deleterious action of light on bark.

The injurious action of light on the Chinchona bark and alkaloids was clearly pointed out many years ago by Pasteur,* a Chemist, to whom our present knowledge of these alkaloids is largely indebted. It is on account of this destructive action of light that he recommended shielding the bark from sun-light while drying. Pure colourless solutions of the alkaloids are soon coloured brown and partially decomposed by exposure to sunshine. The same change takes place when dry or moist sulphate of Quinine is insolated.

Exporimental verification.

15. In order to verify these facts in the climate of the Neilgherries, I prepared from Red Bark pure colourless solutions of each alkaloid and sealed them up in vacuo in glass tubes, in order to eliminate possible oxidation. After three days' exposure to the sun's rays they all became coloured, while similar solutions preserved in the shade remained unaltered. The tube containing Quinine was opened after a fortnight's exposure, and its contents examined. It was then found that a considerable quantity of a dark coloured resinous substance had been formed, and that much of the alkaloid had lost its power of crystallizing. I would submit that these circumstances are very significant, when applied to the elucidation of the cause of some of the changes occurring in the living bark, and are most suggestive of future experiments in the cultivation of the latter.

Moss does not prevent oxidation.

16. It has been stated that the action of the moss is to protect the alkaloids from oxidation. This is contradicted by the circumstance that moss does not exclude either air or oxygen. It is also incompatible with the fact that the Quinidine produced under moss in Micrantha bark is really a more oxidized substance than the Chinchonine produced in the natural bark when fully exposed to the air.

Natural renewed bark.

17. It appeared to me that an examination of bark that had been renewed by natural processes, without the application of moss, would possess considerable interest. It was suggested by a statement in Howard's "Nueva Quinologia of Pavon," and also given on the authority of Ruiz.† I was able to obtain a small quantity of such renewed bark from two Succirubra trees which had been injured and partially stripped of their bark by the falling of a log in October 1864. The

* Comptes Rendus XXXVI. p. 26. and XXXVII. p. 162. Also Kopps Jahresbericht 1853, p. 419.

† Nueva Quinologia. C. Uritusinga, p. 3.—"They cut off (Don Riofrio told me) the whole of the bark of the trunk of a small tree, leaving only a broad strip so as not to destroy the tree, which gradually replaces its loss; and the second time of cutting the bark is called *cascarillas rescatas*, and esteemed of superior quality."

renewed bark was thicker than that of the natural bark, measuring 0·19 to 0·22 in. instead of 0·16 in. and had replaced itself mainly from the edges of the wound; not from the surface, as is the case in mossed bark, but its analysis gave but five per cent. of alkaloids, of which about 3·25 appeared to consist of Chinchonidine and Chinchonine. Unless, therefore, the effect had been impaired by the lapse of time or the character of the injury, the quality of this renewed bark does not appear to corroborate the statement I have had the honour to cite above.

Rationale of mossing the bark.

18. I would submit that the foregoing facts and considerations render it highly probable that the exposure of the *living* bark to direct sun-light has the effect of diminishing the yield in alkaloids, and hence the advantage of direct protection.

I would beg leave to defer a comparative estimate of the respective values of the three varieties of C. Officinalis till a subsequent report.

C. Lancifolia.

19. An analysis of the bark taken from a plant of C. Lancifolia, two years' old, yielded 0·8 per cent. of alkaloids, in which (though but a very small amount of bark was at my disposal) I was able to obtain distinct traces of a crystalline sulphate.

C. Micrantha.

20. An analysis of the trunk bark of C. Micrantha of four and a half years' old yielded the following numbers expressing per-centages in dry bark :—

Total alkaloids	7·1
Alkaloid soluble in Ether...	0·3
Chinchonine	6·8
Crystalline Sulphates	None

Value of Micrantha bark.

This large amount of Chinchonine crystallized from solution in alcohol with the greatest readiness and purity, forming splendid crystals 0·18 in. long. Huanuco bark contains usually only about 2·0 per cent. of alkaloid. Should Chinchonine come into use as a febrifuge (as appears not improbable from the experimental results of the Chinchona Commission,*) this Micrantha bark will furnish a most easy and abundant source. The tree rivals C. Succirubra in rapidity of growth, and the bark at present is 0·17 in. thick. It loses on drying 73 per cent. of water.

Advantages of working with fresh bark.

21. Nearly all the above analyses were made with the fresh undried bark of the trees. Some preliminary experiments shewed me that the bark in the "green" condition presented several advantages which facilitate its examination for alkaloids. The latter are extracted with far greater ease from the fresh than from the dried and powdered bark; and with much less expenditure of acid and labour, and consequently with diminished risk of error or alteration in composition. I am of opinion that this property of the fresh bark will eventually become of considerable importance. For purposes of quotation, it is of course indifferent whether the analyses are conducted with the fresh or the dried bark, provided the process of drying be conducted with proper care.

Results communicated to Mr. McIvor.

22. I have communicated these and other results of my observations to Mr. McIvor, and have discussed with him various applications to future cultivation. I have had to thank Mr. McIvor for much kind assistance, and also for some valuable information concerning the plantations and their products.

Present success of Chinchona plantations.

23. I trust I may be pardoned for expressing my gratification at finding, from personal examination, that the Government Chinchona plantations offer in their present stage such unmistakeable indications of success.

24. I have the honour to forward by banghy four specimens of alkaloids prepared from Red Bark, and illustrative of the foregoing report.

* Proceedings of the Madras Government, No. 302, 1867.

No. 207. ORDER THEREON, 12th April 1867, No. 855.

Miscellaneous.

1. The Government have perused with much interest Mr. Broughton's very encouraging Report, which will be forwarded to the Secretary of State, and communicated, with the recent Report of the Chinchona Commission, to the Governments of India and of the other Presidencies.

2. They note with satisfaction Mr. Broughton's testimony to the value of the mossing process introduced by Mr. McIvor, and request that the results may be recorded in all reports of bark analysis when the tree has been thus treated.

3. Mr. Broughton will proceed to Madras on duty on the arrival of the ship containing his apparatus, for the purpose of taking charge of the cases and superintending their conveyance to Ootacamund.

(True Extract.)

(Signed) W. HUDLESTON,
Secretary to Government.

To J. Broughton, Esq.
,, the Revenue Board.
,, the Inspector General, Medical Department.
,, the President Chinchona Commission.
,, the Superintendent Government Chinchona Plantations.
,, the Accountant General.

No. 533. Read the following letter from J. BROUGHTON, Esq., Quinologist to Government, to the Secretary to Government, Revenue Department, Fort Saint George, dated Ootacamund, 13th July 1867 :—

1. I beg permission to complete, in the subsequent pages, the account of the results obtained in an analytical examination of the Chinchona of the Government plantations, the earlier part of which I had the honour of communicating in my Report dated 1st April 1867. This examination was absolutely required, in order to obtain as far as possible a knowledge of the *existing* conditions under which future work will have to be conducted.

2. It is for this reason also that I have paid special attention to the products of the Chinchona barks while in their fresh, green state, before being subjected to those processes of drying and transit, which I have reason to think considerably modify their chemical nature. By having the plants themselves so near at hand I possess a great advantage, which will not fail to lead to valuable results.

Bark in its fresh state.

3. In the report above referred to, I had the honour of quoting some analyses of one of the varieties of Crown Barks, namely that of C. *Officinalis* var. *Bonplandiana*. We possess, however, two other varieties of Chinchona Officinalis, respectively named vars. *Condaminea* and *Crispa*, and it appeared desirable to make a comparative examination of the bark of each under similar conditions of age, locality, elevation, &c.

Crown Barks.

4. Analyses of two samples of the trunk bark of var. *Bonplandiana*, of three years eight months old, from Dodabet plantation, and grown on grass land, yielded the following results, calculated in per-centages of dry bark :—

C. Officinalis var. Bonplandiana.

Statement of Analyses.

	I.	II.
Total alkaloids	3·84	3·91
Quinine	1·64	1·83
Chinchonidine and Chinchonine	2·20	2·08
Sulphate of Quinine obtained crystallized ...	1·5	1·61
Sulphate of Chinchonidine obtained crystallized...	1·74	1·80

The thickness of the finer specimens of this bark was about 0·12 in. It contained an average of 73 per cent. of water.

5. An analysis of the bark of C. *Officinalis* var. *Condaminea* yielded the following numbers :—

Var. Condaminea.

Statement of Analysis.

Total alkaloids	4·08 per cent.
Quinine	2·05
Chinchonidine and Chinchonine	2·03
Crystallized Sulphate of Quinine obtained ...	1·54
Do. do. of Chinchonidine obtained	1·70

The amount of water in this bark was 73 per cent. For this fine variety of Crown Bark this country is indebted to Mr. Howard.

Var. Crispa.

6. Analyses of the bark of C. *Officinalis* var. *Crispa*, grown on grass land of the same age as the preceding varieties, yielded in per-centages of dry bark:—

Statement of Analyses.

	I.	II.
Total alkaloids	3·72	3·81
Chinchonidine and Chinchonine	1·42	1·54
Quinine...	2·30	2·27
Sulphate Chinchonidine obtained crystallized ...	0·80	0·87
Sulphate Quinine obtained crystallized	1·95	1·75

Other determinations of the gross amount of alkaloids in this variety of bark yielded respectively 3·31 per cent., 3·70 per cent., and 4·1 per cent. The mean of results being, therefore, 3·73 per cent.

Discrepancy with Mr. Howard's analysis.

7. From a report on this bark by Mr. Howard, dated February 1867, I observe that he arrives at very different conclusions respecting its value.* I have, however, spent much time in carefully verifying the grounds of my opinion, and have no hesitation in affirming that this variety of Crown bark is not essentially inferior in its yield of alkaloids to the other two. I believe the great discrepancy between Mr. Howard's analysis and my own, can be explained either by an unfavourable specimen of bark reaching him, or more probably by the quality being deteriorated by the mode of drying. It will also be observed that this bark contains Chinchonidine and not Quinidine. This result I have carefully corroborated by obtaining all the characteristic reactions of Chinchonidine. In examining its solution by polarized light, I obtained a strong rotation of the plane of polarization to the left and not to the right, as in the case of Quinidine. The reactions of quinidine I failed to obtain. I have the honor to forward a specimen of pure sulphate of Quinine obtained from this bark.

Similarity of Crown Barks in yield.

8. From the above data I am compelled to conclude that there is scarcely any difference of yield in the three varieties of C. Officinalis as grown on the Government plantations. I would place little stress on the variations in the amount of Chinchonidine, as indicating a constant peculiarity in either kind. It is very remarkable that the specimens of the bark of var. Bonplandiana, which were one year older than those whose analysis is above given, and which were grown under partial shade, yielded little of this alkaloid, a circumstance which I had the honor of mentioning in a former report.†

Chinchonidine in Indian barks.

* "No. 8. C. *Officinalis* var. *Crispa*.—Original bark unmossed.
Crystallized Sulphates ... ... 0·259
Alkaloids soluble in Ether ... ... 0·370
Insoluble in Ether, Chinchonicine a trace. ... ...
0·629."—P. 2 of Report.

"It must be evident that the var. Crispa should not be propagated, as it will not repay the expense of cultivation."—*Ibid.* P. 3.

† Proceedings of Madras Government, Revenue Department, No. 206, 12th April 1867.

Dr. de Vrij found that the Calisaya barks of Java were somewhat similarly affected, and contained more quinine when grown under partial shade. I think there are ground for believing that when the branches of our trees are sufficiently expanded to screen their bark from direct sun-light, the amount of Chinchonidine in these barks will be found to diminish. The substitution to a greater or less extent of Quinine by Chinchonidine is a very general characteristic of all our best barks, though the range of replacement is wider in the Red.

Value of Crown Barks.

9. For the manufacture of pure crystalline salts of the alkaloids, the varieties of C. *Officinalis* yield the most suitable barks in our possession. Their alkaloids crystallize as sulphates with singular ease, and are readily purified. The very considerable yield of such young trees (three years eight months) is worthy of special remark.*

Similarity of botanical structure.

10. The similarity in the amount of alkaloids yielded by the Crown barks is in harmony with the similarity of their botanical structure. The three varieties resemble each other so greatly that except in the case of individual plants, which possess in a special degree the attributed marks of their variety, it is very difficult to distinguish them with certainty. They are all mingled on the plantations. Had it not been for the kind and valuable assistance I have received from Mr. Batcock, who has taken much pains to select me specimens of undoubted origin, it would have been scarcely possible for me to have made the comparative examination I have had the honor to cite.

Leaves.

11. I have also made a careful investigation of the leaves of *C. Officinalis*. I worked with 3 lbs. of the fresh leaves; but though a considerable precipitate was at first obtained, I was finally unable to detect even a trace of alkaloid. I conclude, therefore, that the leaves of this species are destitute of value.

Fruit.

12. A similar examination was made with the ripening fruit. In this case I succeeded in obtaining indications of alkaloid; but the amount was so minute that although I worked with a large quantity of the fruit, I was unable to determine its nature with certainty, nor did the most delicate tests for quinine indicate that substance. The fruit certainly contains less than 0·00002 per cent. of its weight of dubious alkaloid, and is practically worthless for officinal preparations.

13. I have already had the honor of communicating the results of an analysis of the bark of *C. Micrantha*.†

---

* Since the above was written, I have obtained as much as five per cent. of alkaloids from trees of the same age, growing under very favourable conditions of soil, aspect, &c.

† Total alkaloids ... ... 7·1 per cent.
Soluble in Ether ... ... 0·3
Chinchonine ... ... 6·8
Crystalline sulphates ... ... None.—Report dated 1st April 1867.

14. An analysis of the trunk bark of *C. Nitida*, four and a half years old, from Neddivuttum, gave the following percentages of alkaloid calculated for dry bark :—

C. Nitida.

Total alkaloids	6·00 per cent.
Alkaloid soluble in Ether	0·32
Chinchonine	5·54
Quinidine	0·14
Crystallized sulphate obtained	0·10

The bark was 0·17 inch thick, and contained 69 per cent. of water. A microscopic examination shewed a great abundance of resin cells with but few cortical fibres. The Chinchonine obtained, crystallized with readiness. This bark and its products shewed much similarity with those of C. Micrantha, though the alkaloids obtained were somewhat less in quantity. Six per cent. is, however, a large yield, and is treble that of the American *C. Nitida* bark.

15. The trunk bark of *C. Peruviana* gave, on analysis, the following numbers calculated for one hundred parts of dry bark :—

C. Peruviana.

Total alkaloids	6·25
Soluble in Ether	0·41
Chinchonidine	2·00
Chinchonine	3·84
Crystallized sulphate Chinchonidine obtained	1·80

The bark was 0·16 inch thick, and contained 72·9 per cent. of water. It differs from the other Grey Barks by containing two per cent. of Chinchonidine, differing in some respects from ordinary Chinchonidine, though its optical properties are apparently the same.*

16. From the foregoing analyses it appears that although the Grey Barks do not contain quinine, they are among the richest we possess in their yield of alkaloids. I would submit that the results obtained by the Chinchona Commission, respecting the efficacy of the alkaloids produced by these plants, hardly justify the disregard with which the Grey Barks have hitherto been treated. I would suggest that the cultivation of the beautiful-leaved *C. Peruviana* might be extended, with considerable advantage in many cases. A few plants interspersed among future plantations of *C. Succirubra*, would do much to relieve the monotonous uniformity of appearance produced by the latter.

Value of Grey Barks.

* I believe, with Mr. Howard, (Nueva Quinologia,) that this alkaloid is identical with that described by Wittstein. I am at present unable to refer to Wittstein's Memoir, which is necessary for complete confirmation.

17. An examination of the species of Chinchona that is designated "Unknown name" yielded the following results. In the dry bark :—

"Unknown name" Bark.

Total alkaloids	1·2 per cent.
Alkaloid soluble in Ether	0·39
Chinchonine	0·81
Crystalline Sulphates	none*

The bark contained 73·4 per cent. of water. The alkaloids obtained are deficient in quantity, and are purified with extreme difficulty from the bitter resin with which they are associated. The amount of chinchonine that I was able to obtain in a crystalline state was small.

18. The cultivation of *C. Pahudiana* has long been abandoned. I made, however, for my own satisfaction, an examination of the bark. From it I was only able to obtain 0·3 per cent. of alkaloid. The bark of this species is thin, and a microscopic examination shewed that the fibres of the liber are more abundant and of larger size than those occurring in the more valuable kinds. Its structure presents few of the indications which are said to characterize the valuable kinds of Chinchona.

C. Pahudiana.

19. Among the unpromising looking bushes, which are our eldest representatives of the *C. Calisaya*, there are but three whose bark is available for analysis. As this kind has already been examined by Mr. Howard, and its cultivation discontinued, I thought it better to reserve the examination of these few trees till special circumstances may render it necessary.

C. Calisaya.

20. Experiments are in progress for the determination of the best season for cropping the bark on the large scale, but some time must elapse before these are complete. Comparative trials of the various methods of drying the bark for exportation must be postponed, till the atmosphere is less saturated with watery vapour than it is at this season.

Subjects in course of investigation.

21. In addition to the results I have had the honor to communicate in the foregoing paragraphs, I have been fortunate enough to obtain some of interest connected with the influence of soil, and others relating to the physiology of the alkaloids and their occurrence. But until the application of these results has been verified by repeated experiments I will, with the permission of Government, refrain from communicating them.

22. I shall have the honor of communicating further information on the effects of mossing the barks of the various kinds, as soon as the trees I have thus treated have been allowed sufficient time to yield bark available for analysis.

23. The question respecting a ready means of utilizing the barks in the form of some simple preparation for therapeutical purposes in this country is receiving my best attention.

Officinal preparation of C. barks.

* Since Chinchonine crystallizes more readily in the free state, I invariably exclude it from the sulphates.

No. 534. ORDER THEREON, 26th July 1867, No. 1,711.

Miscellaneous.

1. Ordered that the above report be forwarded to the Secretary of State, together with the sample of pure Sulphate of Quinine obtained from the bark of C. *Officinalis* var. *Crispa.*

2. It is observed that the samples of alkaloids prepared from the Red Bark, and received with Mr. Broughton's first report, were similarly forwarded.

3. The present report will also be communicated to the Governments of India and of the other Presidencies, and copies of both reports, together with that of the Chinchona Commission, will be forwarded to the Governments of Ceylon, the Straits' Settlements, Batavia, and the French Settlements in India.

4. The Government desire that attention be given by the Superintendent of the Chinchona Plantations to the more extended cultivation of the Grey Bark varieties, and that Mr. Broughton's suggestion for the intermingling of the C. *Peruviana* in future plantations of C. *Succirubra* be carried out.

5. It seems undesirable to extend the cultivation of the variety designated "Unknown name," the bark of which appears to be comparatively valueless. The Government will look with interest for Mr. Broughton's further reports.

(True Extract.)

(Signed) W. HUDLESTON,
Secretary to Government.

To J. Broughton, Esq.
,, the Revenue Board.
,, the Inspector General, Indian Medical Department.
,, the President Chinchona Commission.
,, the Superintendent Government Chinchona Plantations.
,, the Inspector General, British Medical Service,
,, the Conservator of Forests,
,, the Agri-Horticultural Society,
,, the Commissioner of Mysore,
,, the Resident of Travancore,

} With Mr. Broughton's former Report and Report of Chinchona Commission.

Exd. S. T. Augustin.

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"Unknown name" Bark.

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Alkaloid soluble in Ether	0·39
Chinchonine	0·81
Crystalline Sulphates	none*

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Subjects in course of investigation.

21. In addition to the results I have had the honor to communicate in the foregoing paragraphs, I have been fortunate enough to obtain some of interest connected with the influence of soil, and others relating to the physiology of the alkaloids and their occurrence. But until the application of these results has been verified by repeated experiments I will, with the permission of Government, refrain from communicating them.

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Officinal preparation of C. barks.

* Since Chinchonine crystallizes more readily in the free state, I invariably exclude it from the sulphates.

Revenue Department

No. 2.

To,

The Commissioner for the
Government of the Territories of
His Highness the Maha Rajah of Mysore

Sir,

I am directed to forward for your information Copies of the undermentioned papers.

Report of the Commissioner appointed to test the efficacy of Chinchona Alkaloids, dated 28th February 1867.

Report of Mr. Broughton, Quinologist on the results of his examination of the various products of the Government Chinchona Plantations, dated 1st April 1867.

Further Report of Mr. Broughton on the same Subject, dated 13th July 1867.

Fort St. George
3rd August 1867.

I have the honor to be &c.
Signed J. Maddison.
Secretary to Government

Secl No. 2619
Decbl. 1867.

S 47

Mysore Commissioner's Office
Bangalore 16th August 1867.

Copy of the foregoing with its original enclosures, are forwarded for perusal to the Superintendent of the Chickballapoor Division, who will pass them on to the Superintendent of the Nelamangalam Division, and thence to the Amildar of the Sugar Division, who will return them to the Commissioner's Office.

"By Order"

[illegible]

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C – 33 –

Lieut. Gen. 1867 No. 2700
From The Offg Secretary 332

To The Compiler
Imperial Gazette

Dated 13th Augt
Despatched
Received

Enclosures No.

General No. 2700
Genl No. 383. } 1867–68.

Forward the accompanying Proceedings of the Viceroy & Governor relating to Chinchona Plantations and request its publication in the next issue of the Imperial Gazette, in continuation of page 611 of the first Supplement of the 3rd Augt 1867

This is forwarded in lieu of the Circular Letter of 26th July 1867 to the Commissioners

By Order
for Offg Secy

Yw 21

No 290
Sec

S.L. 9

No. 6. C.
To 8th April 1916

The Supt. Botanical Station
Cairo,

In acknowledging the receipt of your letter No. 156/3 of the 11th instant, I am directed by the Commissioner to communicate his authority to your procuring from Botaccamund, one dozen 200 plants of the Australian Gum Tree and one bale of Eucalyptus and Acacia cuttings.

2. The usual freight and thermometers will be forwarded to your address at this Office; and the Railway charges will be debited to you whether the consignment is received or not.

I have &c

Secretary

To Supt Govt Farm Ghizeh

D 16/4/16

No 245/20 of 14 April 16 Supt Ghizeh

General

From 1868.

No. 290
1868
5

To The Superintendent
Ashtapum Dº

Dated
Despatched 18th April
Received

Enclosures No.

General No. 290
J.C. No. 5
1868-69.

Submitted to receipt of letter No. 15 of the 11th instant from Commissioner authorizing the Plants &c. from Cawnpore.

To the Arsenal

C18.

From 1869. No. 145.

The Offg. Inspector General of Hospitals
Indian Med. Service

To

Dated
Despatched
Received 25 February 69
Read 27th do

Enclosures No.

General No. } 186 –6.
No. }

Forwards copy of a Report submitted by the Committee appointed to examine the properties of the above Cinchona Alkaloids to the Govt. of India in the Home Dept.

I. G. Circular 1869 No. 3

5210

52 Rec'd 6/3/69.

FROM

THE COMMITTEE APPOINTED TO EXAMINE THE PROPERTIES OF THE CINCHONA AL

To

THE SECRETARY, GOVERNMENT OF INDIA, HOME DEPAR

Calcutta,

SIR,

BY a Resolution of the Governor General in Council, dated 2 1866, we were appointed to be a Committee for the purpose of enquir relative value of the cinchona alkaloids other than quinine. In accor our instructions we have now the honor of submitting an acco proceedings adopted by us, and a report of the result of our enquiry.

We desire to offer an explanation of the length of time that has ela the receipt of our instructions. Without this it will naturally appear enquiry has been delayed or unduly protracted.

At the outset we were of opinion that at least a full year would be for experiment. The fevers which prevail at different seasons in India shew ence of type and character, and of these it was indispensable [illegible] of the investigation that the largest possible number and variety should be embraced.

Further, we anticipated many interruptions from accidents and the exigencies of the public service: and, even in the event of enquiry proceeding without any such hindrance, we were prepared to learn from officers who might desire to treat the question exhaustively, that a further supply of the drugs than was then at our disposal was needed for the purpose, as well as protracted observation of their effects. We resolved accordingly to apply for a further supply and, satisfying ourselves from time to time that the work was in progress, to refrain from urging haste on the selected officers.

Our estimate of the difficulty of collecting materials for a satisfactory report has fallen short of the truth, and even at this late period we are, to our regret, compelled to draw conclusions from evidence which is much less copious than we had hoped to obtain; and are entirely without information from some sources to which we had looked for much assistance.

Among these sources are included the two institutions on which, from the abundant means and appliances at command and the strength of the medical staff, we had mainly relied for an examination of the physiological properties of the alkaloids; the Presidency General Hospital and the Calcutta Medical College. This deficiency is due to the fact that in the former case, Doctor Palmer, who is said

to have devoted much care and attention to the subject, left India before he had completed his experiments; and in the latter, Doctor Francis, who had undertaken the enquiry, was removed by ill health. From the General Hospital, therefore, we have a short and imperfect statement of observations; and from the Medical College we are still without a report.*

Having considered the form which the enquiry might most conveniently take, we forwarded the following scheme, with a supply of the alkaloids, to a number of medical officers, who had, with their own concurrence, been selected by the Inspector General of Hospitals, H. M. British Forces, and the several Deputy Inspectors General of the Indian army; due attention being paid to the localities where they were stationed as to the known prevalence of malarious disorders.

MEMORANDUM.

The Committee suggest the following proposition, as the basis of the enquiry now being made into the properties of the cinchona alkaloids:—

1. Are the physiological effects of the alkaloids the same in kind and degree as those of quina, viz., gastro-intestinal irritation, action on the pulse and vascular system generally, on the cutaneous function, on the cerebro-spinal system, and on the composition of the urine?

2. What are the therapeutical effects (*a.*) of small doses, used for the purposes for which small doses of quina are ordinarily prescribed; and (*b.*) of larger doses, such as those employed when the specific and rapid action of quina is desired; that is as anti-periodics in the various forms of intermittent disorder, febrile or otherwise; and as febrifuges in the severer forms of continued and remittent malarious fevers.

"The Commission seek to do no more than indicate the points on which information is essential to the framing of a satisfactory report on the alkaloids. There are many details of physiological and medicinal [redacted] included [redacted] foregoing propositions, on which the opinions of individual [redacted] or sections of the profession may receive elucidation in the course of a medical officer's enquiry, and new questions may arise out of the facts observed by him from day to day. Particulars on all such points will be full of interest and importance, and cannot fail to further the object which the Government has in view, but their treatment must of necessity be left to the means and opportunities at the command of individual officers. To specify any of them, in a scheme suggested for the sake of uniformity, would probably impede the work in hand by diverting attention from essential matters.

It should be observed that an estimate of the comparative value of the alkaloids with each other will form an important part of the enquiry and the recorded information should have due reference to this.

In conclusion the Commission would bring to your notice the necessity for providing that each report be fully furnished with the observed facts which have contributed to form the opinions of the reporting Officer.

They may be given either in the text of the report or in the form of an appendix. The latter would be more convenient in reviewing the several papers.

Medical Officers will, no doubt, readily perceive that in order to balance testimony which will, of a certainty, be in some instances conflicting, it is indispensable that the Commission be thus provided with the evidence on which every conclusion is supported."

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* Since our report we have received from Dr. Ewart, of the Calcutta Medical College, an account of some experiments with the alkaloids carried out during the month of October 1866. The period was limited and the cases not numerous, but their character was strongly marked in every instance, and the result of treatment well pronounced. Dr. Ewart states his opinion in the following "general conclusions" which are fully sustained by the facts he adduces.

Sulphate of Quinidine is an excellent anti-periodic in doses of 5 to 20 grains. It is probably not inferior to quinine, and is easily tolerated by the stomach. It is a good bitter tonic in smaller doses, and may be combined with ferruginous medicines. It is less disagreeable to the taste and stomach than quinine, and its use is not accompanied by the unpleasant effects known as cinchonism.

Sulphate of Cinchonidine stands next in anti-periodic power in 10 to 20 grains doses and as a tonic in smaller quantities, it is "agreeable to the stomach" and is not accompanied by symptoms analogous to cinchonism.

Sulphate of Cinchonine is doubtless a powerful anti-periodic in doses of from 10 to 20 grains. "The irritability of stomach caused by it is the great objection to its ever taking rank as a substitute for either of the other alkaloids," but it may be obviated by injecting the medicine in solution hypodermically. It is a good tonic in small doses.

The reports which we have received are from the officers and stations named in the margin. In analysing them we shall deal separately with the several alkaloids, collating the information which the reports convey, and casting it into the form of the propositions laid down in the above scheme.

Dr. Woods, H. M. 107th Regt., Allahabad.
Dr. Palmer, Presidency General Hospital, Calcutta.
Dr. Bleckley, H. M. 40th Regt., Lucknow.
Dr. Fogo, R. A., Lucknow.
Dr. Bensley, Civil Surgeon, Midnapore.
Dr. Staples, H. M. 19th Regt., Nowshera.
Dr. French, Civil Surgeon, Rajshahye.
Dr. McSheehy, 7th Royal Fusiliers, Sangor.
Dr. Bateson, Civil Surgeon, Umballah.

Physiological effects of Alkaloids.—On this portion of the subject we have the testimony of seven observers. In six of the reports, however, we have record only of the effects incidentally manifested on patients to whom the drugs were therapeutically administered; which, though of much interest and value, from the uniform quality of operation noticed, give but imperfect evidence of intensity of action, and especially of the comparative potency of the drugs.

It is, of course, by results arising in these circumstances that the therapeutical use of the alkaloids will be influenced; these records, therefore, will have full practical utility; but for the purposes of scientific enquiry into the true physiological effects of the agents it is necessary that careful experiment be made on their action in health. We have been fortunate in receiving a full account of a series of such experiments from Dr. Bensley of Midnapore, which as far as they go, leave little to desire for closeness of observation, accuracy of record, and careful avoidance of fallacy.

There arises then a natural distinction between the observations of Dr. Bensley and those of the other officers; which distinction we shall recognize by giving them separate consideration, treating the former singly and combining the latt general statement of symptoms produced in fever patients by each of th except in cases where great variety of operation appears to call for specifi

Cinchonidine.

Of cinchonidine administered to fever patients there is concurrent te to the production of symptoms closely resembling those of q head-ache, singing in the ears, deafness, giddiness, dimness o and muscular weakness. Dr. Fogo, however, has found it less productive o symptoms than either of the others. He pronounces it to be second to qu alone in its action on the vascular system, last of all in producing gastro-inte irritation and in affecting the urinary and cutaneous secretions. It has no says, been found in the urine. In some cases moderate doses (8 grains cinchonidine have proved sufficient for the production of these effects, but i generally remarked that the drug is less potent than quinine. The exception this rule is the experience of Dr. McSheehy, who "thinks its physiological effe are more marked than those of quinine." Dr Woods on the other hand obser that, in grave cases large doses may be given without the production of an physiological effects." Thus upon the whole, great similarity of action is establishe with quinine, but there is also indication of a natural antagonism betwee cinchonidine and fever poisons, which disturbs the conclusions and points to the usefulness of special experiment in healthy subjects.

The subjects of Dr. Bensley's experiments were prisoners in jail living under the best sanitary conditions, and the points of enquiry were thus arranged.

(a) Action of small doses, from three to five grains.

(b) Of large doses, fifteen to twenty grains.

(c) Mixed experiments. Firstly, to ascertain whether certain effects were due to the particular alkaloid employed, or to constitutional susceptibilities with liability to follow the use of all cinchona preparations, and secondly, to determine the comparative strength of the alkaloids.

Of Cinchonidine—It is reported that in doses of three to five grains it is tonic, promoting appetite. It admits of more protracted use than cinchonine, leaves a bitter taste in the mouth, though not for so long a time as cinchonine.

Gastro-intestinal System.—It produces furred tongue, burning in the stomach and along the œsophagus, seldom griping or flatulence unless thirty or forty grains were used: diarrhœa was not observed, and nausea seldom.

Vascular System.—As a rule no marked increase in the frequency of the pulse was noticed, except after repeated doses of fifteen or twenty grains. Palpitation followed the same conditions. Dryness of mouth and drowsiness, but not the sense of fainting which followed the use of cinchonine.

Cerebro-spinal System.—Giddiness and heaviness of head not very severe. Deafness and noises in the ears not observed after the first few doses, and not very intense. Dimness of sight and other visual disturbance. Feeling of intoxication after very large doses. Little change in the temperature of the body, dilatation and sluggishness of pupils occasionally, and muscular tremors and weakness.

Generally it may be said of cinchonidine that it has no special characteristic effects. Its action is mild, resembling, after large doses, that of both cinchonine and quinidine, but in reduced form.

Quinidine.—Concerning the symptoms, which follow the administration of quinidine to fever patients there is much less unanimity among the several observers.

Drs. Woods, Bleekley and Bateson notice head symptoms as rare in occurrence and slight in character, and Dr. Jackson seldom found any symptoms produced. Dr. Fogo on the other hand, observed that cerebro-spinal and gastro-enteric symptoms were frequent, even after moderate and small doses. He also met with increased cutaneous and urinary secretion. He places it after quinine and cinchonine in cerebro-spinal effects; second to quinine alone in acting on the vascular system; after quinine and cinchonine on the gastro-enteric system; equal to cinchonine and before the others, on the cutaneous and urinary systems.

Dr. McSheehy's experience gave him the impression that quinidine was generally more active than quinine in producing physiological effects. Dr. Bensley, experimenting as before, records the following conclusions:

The physiological effects of quinidine in three and five grain doses are the same as those of the other alkaloids. It produces symptoms of cinchonism earlier than either quinine or cinchonidine.

Gastro-Intestinal System.—Furred tongue, burning in the stomach and œsophagus, flatulence, griping, diarrhœa, in a few instances nausea, occasionally vomiting.

Vascular System.—Increased frequency of pulse, and as a rule, marked diminution of the volume, it being very often a mere flickering palpitation of the heart, precordial uneasiness frequently very geat dryness of the mouth and thirst, augmented respiration, and feeling of great faintness and debility.

Cerebro-spinal System.—Giddiness; headache; heaviness of the head; deafness; singing noises in the ears; vision misty; tremor of the muscles; a feeling of intoxication; inability to stand; and in large doses a great deal of restlessness and a general feeling of distress. The temperature of the body is occasionally slightly raised, but the skin remains soft.

The characteristic effects of cinchonine must be noticed as increased frequency of pulse with diminished volume, palpitation, precordial uneasiness, marked debility and faintness. Even in a few cases, where the frequency of the pulse has not been notably raised, the diminished volume has nevertheless appeared.

It is interesting to observe that in two cases, remittent fever shewed itself while the system was experimentally "saturated with cinchonine to a great "extent."

Comparative Physiological Effects.—Dr. Bensley concludes this portion of his report with the following observations on the comparative characters and potency of the three alkaloids.

"Cinchonine shews its characteristic effects most prominently on the "vascular system. Quinidine equally prominently on the cerebro-spinal and "gastro-enteric systems, and produces, in large doses some of, but not all, the "peculiar effects of cinchonine on the vascular system. Cinchonidine is the "mildest of the three, producing no constitutional disturbance, except in "large doses, when it falls into an intermediate position between cinchonine and "quinidine, without producing the great augmentation of pulse and tendency "to syncope of the former, or the severe gastro-intestinal irritation or dila-"tation of pupils of the latter. Lastly, and this we append for completeness "of comparison, quinine assimilates itself with quinidine in its effect on the "cerebral system, but differs from it in giving firmness to the pulse, and seldom "increasing its frequency, in not producing as a rule, dilatation of pupils or "such varied visual disturbance as quinidine, nor so much of gastro-intestinal "irritation. It differs from cinchonine in not inducing palpitation of the "heart, or diminished volume of the pulse.

"With regard to the relative potency of the agents, it may be said that "cinchonine and quinidine are the most powerful, each however shews its force "on a separate system, cinchonine on the vascular, and quinidine on the "nervous system. Comparing the action of equal quantities, cinchonine is "found to produce greater disturbance of the vascular, than quinidine does

The physiological effects of large doses, from eight to twenty grains are, *gastro-enteric* irritation of greater intensity than is produced by cinchonine, much nausea and vomiting, with griping of bowels and occasional diarrhœa; the tongue becoming foul and the appetite impaired.

"*Vascular System.*—Increased frequency of pulse, sometimes diminution of its volume, but in effect only of large and repeated doses, and never marked as in the case of cinchonine. After very large doses palpitation and precordial pain have been noticed, in one instance after twenty grains. There is not that tendency to syncope observed after cinchonine."

"*Cerebro-Spinal System.*—The cerebral symptoms are greater than are caused by any other alkaloid, headache, giddiness; heaviness of head, somnolency, buzzing noises in the ears and deafness; dilatation and sluggishness of pupils cloudiness of vision and *muscæ-volitantes;* a bright halo surrounding objects and even diplopia."

As distinguishing features in the action of quinidine, Dr. Bensley notes, dilatation of pupils, visual disturbance assuming a variety of forms; early appearance of cerebral symptoms with great intensity of these from full doses, almost entire absence of fainting or precordial anxiety; a great tendency to intestinal irritation, and not unfrequently augmentation of the pulse. He makes allusion to the published opinion of Dr. Peacock that the nervous effects are less intense, than those of quinine, and adds, "the whole series of my experiments is opposed to this opinion."

Cinchonine.

With cinchonine also the opinions of those who have administered the drug to fever patients are conflicting. Drs. Woods, Bleekley, Jackson, and Fogo, do not lay any particular stress on the symptoms produced. They speak of cerebral and gastro-intestinal derangement as similar in kind to that resulting from quinine, and notice occasional slowness of pulse. Dr. Fogo places it after quinine, but before the others in cerebro-spinal effects; after quinine and cinchonidine in acting on the vascular system; second to quinine only on the gastro-enteric system; and on an equality with quinine on the urinary and cutaneous functions.

These observations contrast singularly with the experience of Drs. Bateson and McSheehy. The former was prevented from continuing the use of the drug by the nervous symptoms which even small doses produced, and to the latter, all the effects seems greater than those of quinine.

In accordance with the last opinions are the conclusions of Dr. Bensley from experiments made in health.

Its effects he says, when given in small quantities of two or three grains are the same as those of all other cinchona preparations, acting as a tonic and producing a very lasting bitter taste; its use however does not admit of persistence, even in small doses, without producing its characteristic effects. In one case a few two grain doses produced many of the symptoms (in a slight degree) which follow the larger quantities. The effects of doses varying from five to twenty grains are as follows:

" of the cerebral, system. The third place is occupied by quinine, and t
" by cinchonidine."

Taking cinchonidine as his basis, and assuming a certain degree of e
follow twenty-five grains of it, Dr. Bensley considers that the same de
effect would follow the administration of about twenty grains of quinine, s
of quinidine, and ten of cinchonine.

In framing our report on the physiological properties of the alkaloids,
be observed that we have adopted in the main the conclusions of Dr. Be
partly from the manner in which his evidence has been obtained,
leads to true physiological inferences, and partly from the internal evi
borne by his report of special attention devoted to this particular portion
enquiry.

We entertain little doubt, that close analysis of the reports of the
observers would remove some of the more marked discrepancies of op
But such a proceeding would add greatly to the length of this paper, an
the purpose of a general report, would have no value. Under our in
tions it concerns us more, at least in this place, to determine whethe
drugs, or either of them, have absolute and sure activity, than to enter
minutely into questions of differential detail. Relative potency, with t
kaloids, as with other medicines is, and must be expected to remain, a r
of opinion and controversy. The main point of medicinal value will be
trated, and the limits of the physiological action of each drug have been so laid
down, that this action may be utilised for the suggestion or modifica
of practice. It would result only in a fallacious appearance of exactnes
these properties were to be isolated, and so deprived of all useful significa
for the mere purpose of casting them into a scale of relative activity.

We have now to examine the reports with reference to the therapeutic
properties of the drugs.

CINCHONIDINE.—Dr. Bateson of Umballah, after premising that peculiarity
of season had deprived him of opportunity of reporting on the anti-periodic
properties of the drugs, concludes from such experience as he had obtained,
that it is very doubtful whether this alkaloid possesses any influence over
fever. He found it slow in action.

Dr. Palmer observes that, cinchonidine given in much larger doses than
quinine is next to it in efficacy. Dr. Brougham, the Surgeon of the General
Hospital, in forwarding Dr. Palmer's report, notices that this position is not
sustained by the cases recorded, four being successful, and three doubtful;
whereas of eleven cases treated with quinidine all recovered. Dr. Palmer
notes that care was taken to exclude from the experiments all very trivial as
well as very severe cases, which forbids us to suppose that there was any
material difference in the intensity of illness in the two groups. Moreover
the average number of days under treatment was with cinchonidine twenty-
two, with quinidine seventeen; whereupon Dr. Brougham observes, that so

long an average period in ordinary intermittent fever cannot be considered as proof of remarkable success with either drug.

After careful examination of the cases recorded in this report, we find ourselves unable to draw any conclusion from them respecting the action of the drug. The first case, under treatment for three months, must be rejected as not being one of malarious fever. The second was under treatment seven days, but there was no recurrence of fever after the second day, the further detention was therefore precautionary. But the patient received on the same day ten grains of quinine as well as ten of cinchonidine. The third was in hospital from the fourth to the twelfth day of the month; there was no fever after the 6th. The fourth was in hospital from 31st August to 17th September. The nature of the illness was never clearly ascertained, and the termination of the case is not given. The fifth, in hospital from 28th August to 8th September, showed no fever after the 29th. In the sixth and seventh, the nature of the illness was not ascertained. Thus it appears that the third and fifth cases alone support any inference as to the action of cinchonidine and they are of favorable indication, but the "period under treatment" cannot be accepted as of any significance.

Dr. Woods of Allahabad remarks, "this alkaloid ranks next to quinine as "an anti-periodic." He used it in doses of eight grains every four hours; "but," he adds, "in grave cases when used from the commencement, fourteen "grain doses every fours hours were necessary to produce a decided effect."

Dr. Jackson of Meerut reports: "The sulphate of cinchonidine was "given in 273 cases, of which 154 or 56·41 per cent. were successful after one "dose. 119 cases were for several days under treatment or 43·59 per cent."

Of these 11	were 4 days	in hospital
60	„ 5 „	„
34	„ 6 „	„
11	„ 7 „	„
1	„ 8 „	„
2	„ 9 „	„

Or an average period in the severer cases of 5·47 days. Dr. Jackson's experiments with cinchonidine were made in September, October, and part of November, a season when the fever became much more obstinate than it had been during the earlier months of the year, when the other alkaloids were tried. The good effects of cinchonidine Dr. Jackson considers to have been fully established by the low average duration of treatment. He further observes that the undoubted possession by all three in marked degree, of the anti-periodic properties of quinine, renders comparative estimate of their merits difficult. Some experiments were instituted for the elucidation of this special point, which led to the inference that sulphate of cinchonidine appeared to have "decidedly more effect in suddenly checking the disease "than either of the others." It was about equal in value to half the quantity of quinine. Six cases were taken, whereof a dose of 20 grains cured every one on

the second day. Dr. Jackson, thus concludes his report, " of the three
" I am of opinon, and my Native Doctors are the same, that cinch
" by far the most valuable "

Dr. Fogo, also at Meerut, observes, " cinchonidine is, in many
" as energetic as the others; and one thing greatly in its favor
" the physiological effects it produces are not so powerfully manifested,
" off very quickly."

Dr. Staples, (19th Foot) of Nowshera, says, " It was not found in
" tent fever so efficacious as quinidine, but like that drug, was an use
" in convalescence."

Dr. Bensley, of Midnapore, whose therapeutical report treats ma
his statistics entirely, of the collective value of the alkaloids, makes t
ing distinctive remarks of cinchonidine. " It is admirably suited
" cases requiring a tonic or febrifuge, in which at the same time there
" tendency to diarrhœa, or diarrhœa already exists. Among the ca
" found two in which quinine produced irritation of the bowels, but
" dine was well borne. None the less valuable is it, in consequen
" mildness of its influence on the nervous system, in those cases wh
" peculiarity of constitution, are ill able to bear the more powerful a

In continued fevers, Dr. Bensley has had no experience of its use, but he " would prefer it to the others as being least likely to disturb the cerebro-
" spinal or gastro-enteric system."

He has employed it in small doses of three and five grains. His m
is twenty grains. He lays great stress on the importance of previous p
tion, by unloading the portal system, and concludes by saying; " I hav
" cinchonidine extensively in the fevers of children, on account of its mil
" and because it is less liable to produce head and bowel disturbance
" other alkaloids. Upwards of thirty of my cases were children varying in
" from one to nine years. I have such confidence in it that it is now the
" preparation I prescribe for children." Again, " cinchonidine has secured
" itself a position perhaps the most exalted of all, inasmuch as it has afford
" us a good febrifuge for cases which, from peculiar susceptibilities, we
" opposed to the administration of quinine."

QUINIDINE.—Dr. Bateson considers that quinidine checks fever equally with quinine, " without its harsh effects it will check fever where cincho-
" nine and cinchonidine have been given largely." " I have given it to
" natives only, and in doses of ten grains usually."

Dr. Palmer places quinidine after cinchonidine and before cinchonine in efficacy. He gives eleven cases of which we find seven indicate rapid anti-periodic action, the remainder being inconclusive. The " period under treatment" as calculated by Dr. Palmer has as before, no exact significance, being determined in a large measure by the precautionary, probably necessary, detention of patients after fever had ceased to shew itself. The cases are

"failed, but the generality of the cases are opposed to quinine being th
"powerful of the two." Elsewhere he writes, "quinidine has prov
"more successful than quinine in its therapeutical effects."

To test, as far as possible, this striking result, we have carefully e
the evidence on which it is established; and although Dr. Bensley g
four cases treated with quinine, against twelve with quinidine, we a
to conclude, from the previous duration of many of the latter, and the
of effect produced, that the efficacy of quinidine, as exemplified by Dr.
as far surpasses that of quinine, according to general experience, a
in the few instances adduced in the report.

CINCHONINE.—Dr. Bateson found cinchonine "so powerless i
"arresting fever, that it was a hardship upon prisoners to give it to
consequence of the severe nervous symptoms it produced. The ca
are unfortunately recorded in such a manner as to render accurate
impossible, but so far as we are able to interpret them, they do n
to us to warrant so emphatic a condemnation of the alkaloid as D
has pronounced. A general statement of opinion however based, with
on clinical observation, may have foundation which is not open t
on the evidence of an incomplete record of cases.

Dr. Palmer entertains "doubt whether cinchonine can be ra
"anti-periodic at all."

Seven cases are given in the report, but only three of these appear to
us to be illustrative of the question, and they point to early, but n
immediate, arrest of fever by the remedy.

Dr. Woods observes:—"In mild cases of fever given in eight grain do
"every four hours, it checked the fever, and as a rule without produc
"any abnormal symptoms beyond, in a rare case, slight head-ache and giddin
"In severe cases, whether intermittent or remittent, in doses of five to
"grains every four hours, it failed altogether to cure or modify the dis
"a less dose than twelve or fourteen grains producing little effect." In s
cases of fever he considers it unsafe and valueless in the same dos
quinine, but administered in "twice the quantity, it proved an eq
valuable anti-periodic." Dr. Woods was not inconvenienced by other effec
the drug, but in common with Dr. Bensley, notices syncope as one of them.

Dr. Jackson administered cinchonine in 111 cases. Of these 12 were cu
by a single dose or 10·81 per cent. 99 cases or 89·19 per cent. were
several days under treatment.

2	were	4	days in	hospital.
23	"	5	"	"
42	"	6	"	"
25	"	7	"	"
6	"	8	"	"
1	"	9	"	"

or an aveage, of 6·13 days.

In Dr. Jackson's further experiments with six parallel cases, four were cured on the second day; one on the third; and one on the fourth or fifth. He makes no mention of special inconvenience attending the action of cinchonine.

It should be observed throughout, with regard to the periods under treatment recorded by Dr. Jackson, that we are unable to ascertain how far detention may have been probationary. His cases however are so numerous that a disturbing influence of this kind is of small importance as it tends to work its own correction.

Dr. Fogo considers cinchonine "next to quinine in a therapeutical point of view." In some respects he says it exerts its effects more rapidly than quinine, but the severe frontal head-ache caused by it in most of the cases, will preclude its ever taking precedence of quinine.

Dr. Staples holds the opinion that its therapeutical effects are very much below those of quinine; that it does not affect the head, and that a dose of twenty grains often fails to arrest a paroxysm of intermittent fevers.

Dr. French, of Rajshahye, writes, "I am of opinion that for ordinary inter-"mittent fever, cinchonine is a very useful and effective medicine. For remit-"tent fevers, particularly if they are complicated with head symptoms, I deem "its action too slow, and its effect uncertain." He employed it in doses of 5 and 10 grains.

Dr. Bensley regards cinchonine as inadmissible where there is tendency to bowel derangement, in fevers of women and children, and especially with patients labouring under great debility. He considers 15 grains as the extreme quantity that can be given with safety; and with these limitations, includes it in his judgment upon the entire group of alkaloids, which he considers "a valuable addition to our small stock of anti-periodics."

It would seem from the general tenor of Dr. Bensley's report, that he regards cinchonine as inferior in value to quinidine, although in his concluding summary he places it before the latter. The illustrative cases given appear to establish the early and efficient action of the drug, though they would claim for it an inferior degree of efficiency.

General Conclusions.—Having entered as fully as our means permit into the particular merits of each of the alkaloids, it may seem superfluous to state the conclusions at which observers have arrived respecting their collective value. But opinion on the subject has been so emphatically expressed by some of those best qualified to form judgment, and is in some cases accompanied by remarks of so much special technical interest, that it will not be unprofitable if we subjoin the passages which bear on the subject in the reports of those officers who, from the extent and minuteness of their enquiry, are well entitled to speak with authority.

Dr. Jackson's experiments extended over no less than 564 cases. "These "alkaloids are all," he says, "possessed of highly anti-periodic properties in "malarious fever. They were given in the above number of cases without one "fatal termination. It is true that the fever, though generally prevalent "among the prisoners, was of a very mild type; the fact however remains "that the average duration of treatment was about six days" (here Dr. "Jackson omits to reckon the large numbers cured by single doses) "and such a "result can only be accounted for, by allowing the very marked specific effects "of the alkaloids administered. I much doubt if such a result could be obtained "by the administration of any other of the well-known anti-periodics, always "excepting the *facile princeps* sulphate quinine itself."

Dr. Fogo writes, "In small doses all the alkaloids produce the same "therapeutical effects, that is as tonics, anti-periodics and anti-neuralgics. "Hypodermically and internally they have proved successful."

"In large doses they are all equally energetic and produce their effects "rapidly. They have been successfully used as anti-periodics and febrifuges."

"We have now three alkaloids in addition to quinine, all of great power. "Quinine appears to be the most active and certain in its effects, and "from long established reputation, it is not likely to be superseded by any of "the other alkaloids, at least not until they become more known. *In many "constitutional peculiarities where quinine cannot be borne, these alkaloids will "be found good substitutes, and they can all be substituted for each other.*"

Dr. Bensley experimenting on 309 cases thus states his experience, "knowing that quinine possesses anti-periodic properties, and finding that the "physiological action of cinchonine, cinchonidine and quinidine is in the main "similar to that of quinine, we are naturally led to expect that the former possess "similar anti-periodic properties. We are not disappointed, for a reference to "my therapeutical tables will show that they have fully established their "claim to such a character; and even more, for we find that quinidine has "taken the first place in its rapidity and number of cures; that cinchonine "has held a place very little if at all inferior to quinine, and that cinchonidine "stands last. Now if we refer to the physiological experiments we shall find "that quinidine has held the first place among them also, and, in reviewing its "effects upon the several systems we find that it has manifested its influence "on the nervous system more powerfully than on the others, and that quinine, "cinchonine and cinchonidine also manifested a degree of influence on this "system, but that that degree of influence followed precisely the same order, "as the alkaloids have observed in their therapeutical effects. The conclusion "therefore forces itself upon us, that the therapeutic value of the alkaloids "depends upon their making an impression upon the nervous system, and that "their anti-periodic quality is in proportion to the degree of that impression."

"In remittent and intermittent fevers the value of the cinchona alkaloids "is unquestionable. I have not had any cases of continued fever to try "them in."

"In my practice, ten grains of quinidine or quinine or cinchonine and "fifteen grains of cinchonidine form the maximum dose, and as a rule I "have met with no serious disappointments to lead me to adopt larger doses, "nor indeed do I think that others would adopt very large doses, in the event "of failure with a few moderate ones, were more attention paid to the prepa- "ratory treatment of patients. With patients prepared as I have mentioned "a failure will seldom occur, but when a few doses of any one of the "cinchona alkaloids fail, the failure is due not so much to the quantity of "alkaloid given as to the secretory function being still in an abnormal state."

"In all the cases that I have treated I cannot call to mind one which "struck me as obstinately unimpressible by any alkaloid. Perhaps I have "been fortunate in having, during this season, fevers of an unusually mild "type, but I am much disposed to think that a great part of my success "has been due to the previous preparation of my patients."

"With a patient previously well prepared for a febrifuge, whatever the "alkaloid employed, the fever yielded to it with little or no resistance. In "conclusion," says Dr. Bensley, "I beg to say that I look upon quinidine, cin- "chonine and cinchonidine as valuable additions to our small stock of anti- "periodics, worthy of as much, if not more confidence than quinine has "obtained; one of them, quinidine, having proved itself more successful than "quinine, and another cinchonidine having secured for itself a position "perhaps the most exalted of all, inasmuch as it has afforded us a good febri- "fuge for cases which, from peculiar susceptibilities, were opposed to the "administration of quinine."

"So much convinced am I now on this point, that I should feel quite "content were I for the future left to deal with all my fever cases with no "other preparations than quinidine and cinchonidine."

There is, as we have already intimated, some little confusion, in the several passages of Dr. Bensley's report, in which he adverts to the relative value of cinchonidine and cinchonine, but it is of little moment amidst the strong testimony he offers to the absolute value of all.

The remaining reports, without an exception, record opinions of the same tenor as those now cited on the great utility of the three drugs. On account of this unanimity, we have less reason than we otherwise should have had to regret that the number of reports received has fallen so far short of our expectations. There is no longer room to doubt that the alkaloids are capable of being generally used with the best effects in India. They have been compared with quinine, a drug which possesses, more than any other than can be named, the confidence of medical practitioners here; and have been found, by more than one observer, to supplement this sovereign remedy in some of its points of deficiency. The risk attending their use is clearly not greater than in the case of quinine, nor such as to be in any way deterrent; while the

diversity of opinion on their relative usefulness and potency are no m
will be found between any three drugs of the pharmacopœia exami
separate observers, as to reputed similarity of action.

We have the honor to be,

Sir,

Your most obedient Servants,

(Signed) W. A. Green,
Lieut. Col. of Hospls. &c. *Presdt. of Commission.*

(Signed) J. R. Broughton Surgn.
(Signed) C. R. Francis Surgn. Majr. } *Members.*
Surgeon to Majr.

do A. J. Payne M.D. — *Member and Secretary.*

True Cop

C. R. Francis

Offg Secty Inspector Ge

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